The Welding Engineer

Founded by L. B. Mackenzie, 1916

DECEMBER, 1926 — VOL. 11, No. 12

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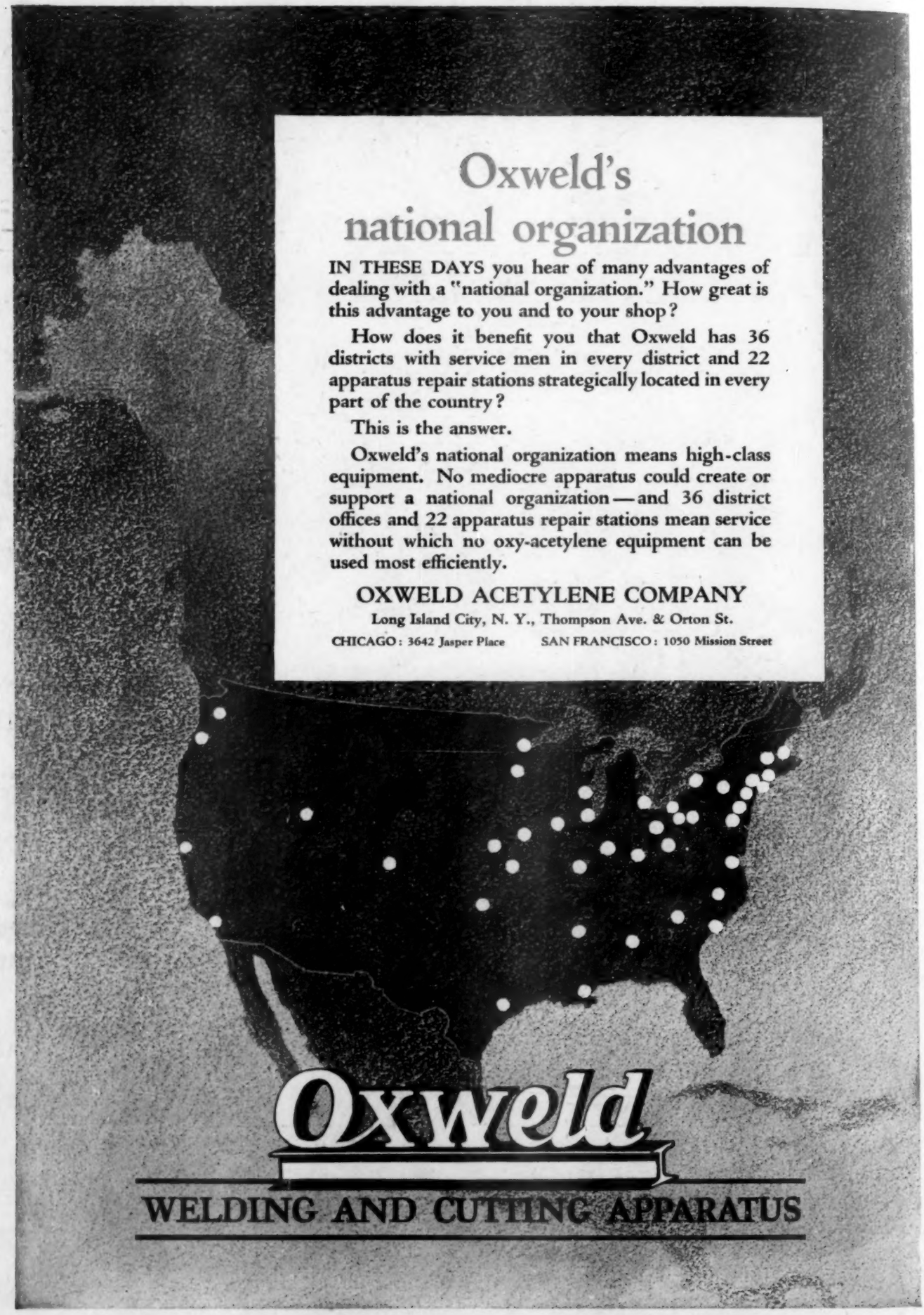
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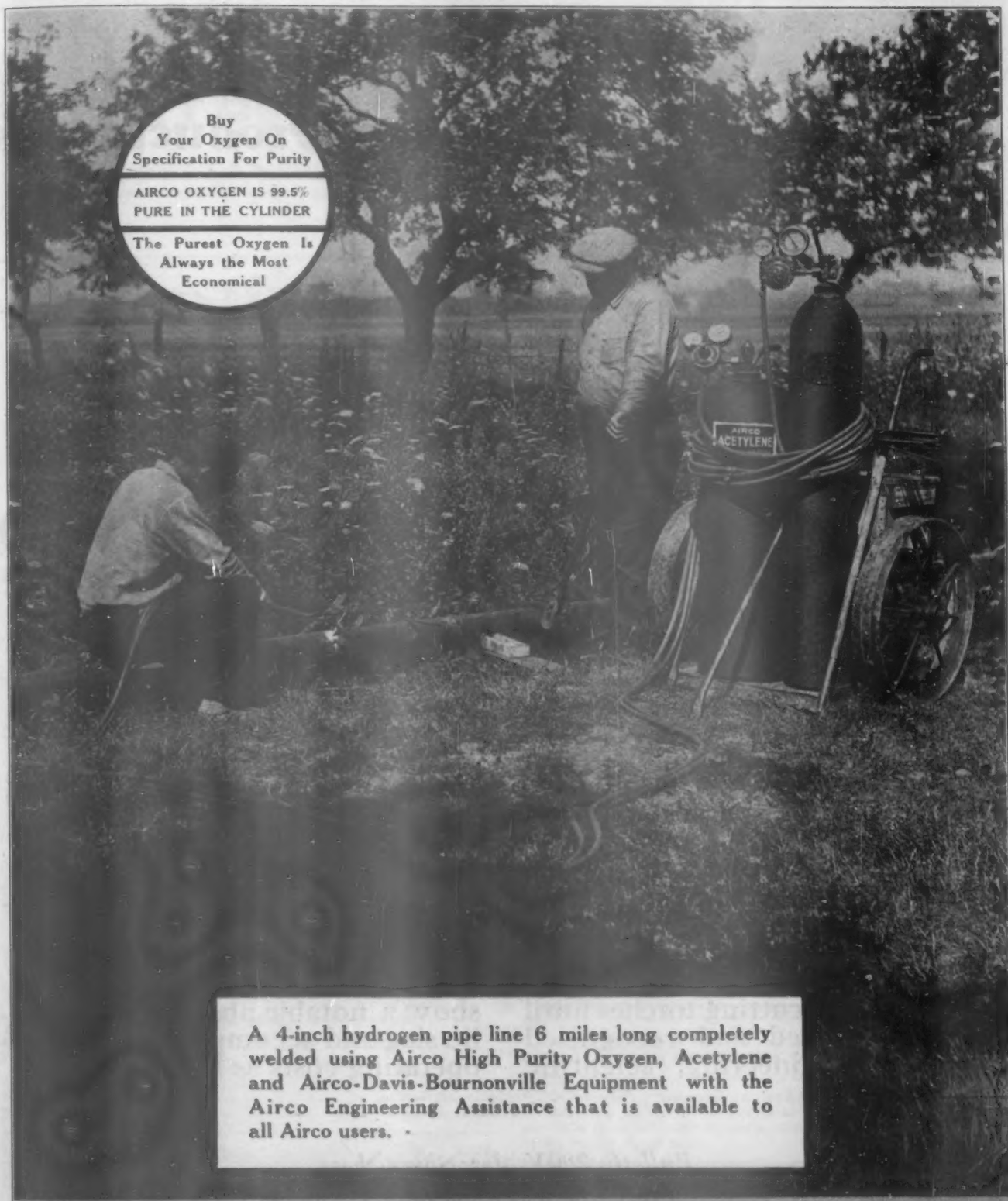

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Founded by L. B. Mackenzie, 1916

Volume 11 December, 1926 Number 12

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Whatever your connection with the welding industry may be,

The Welding Engineer
wishes you a
Merry Christmas
and
Happy New Year

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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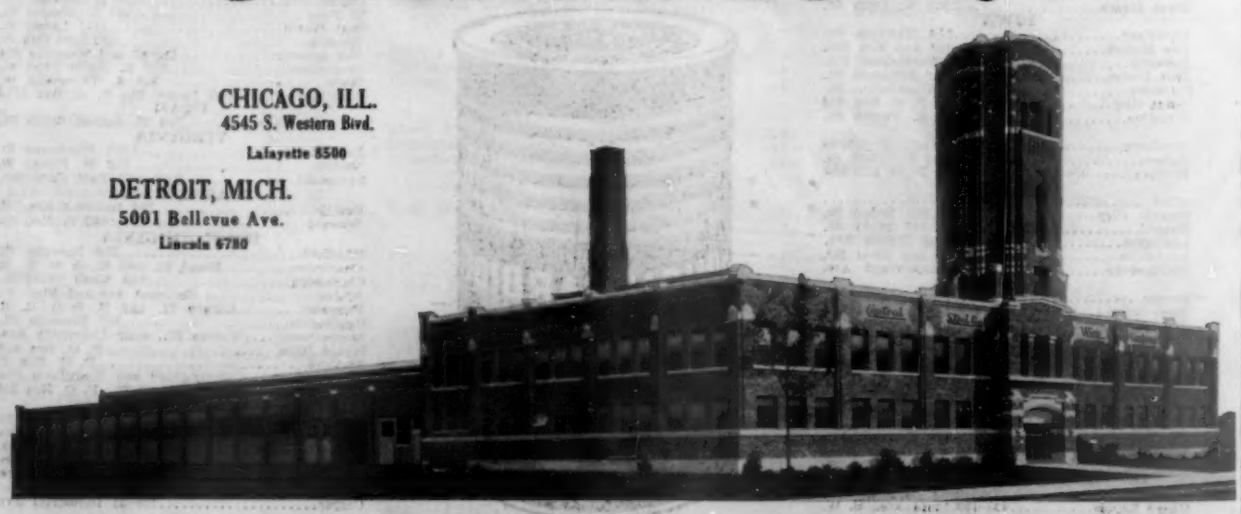

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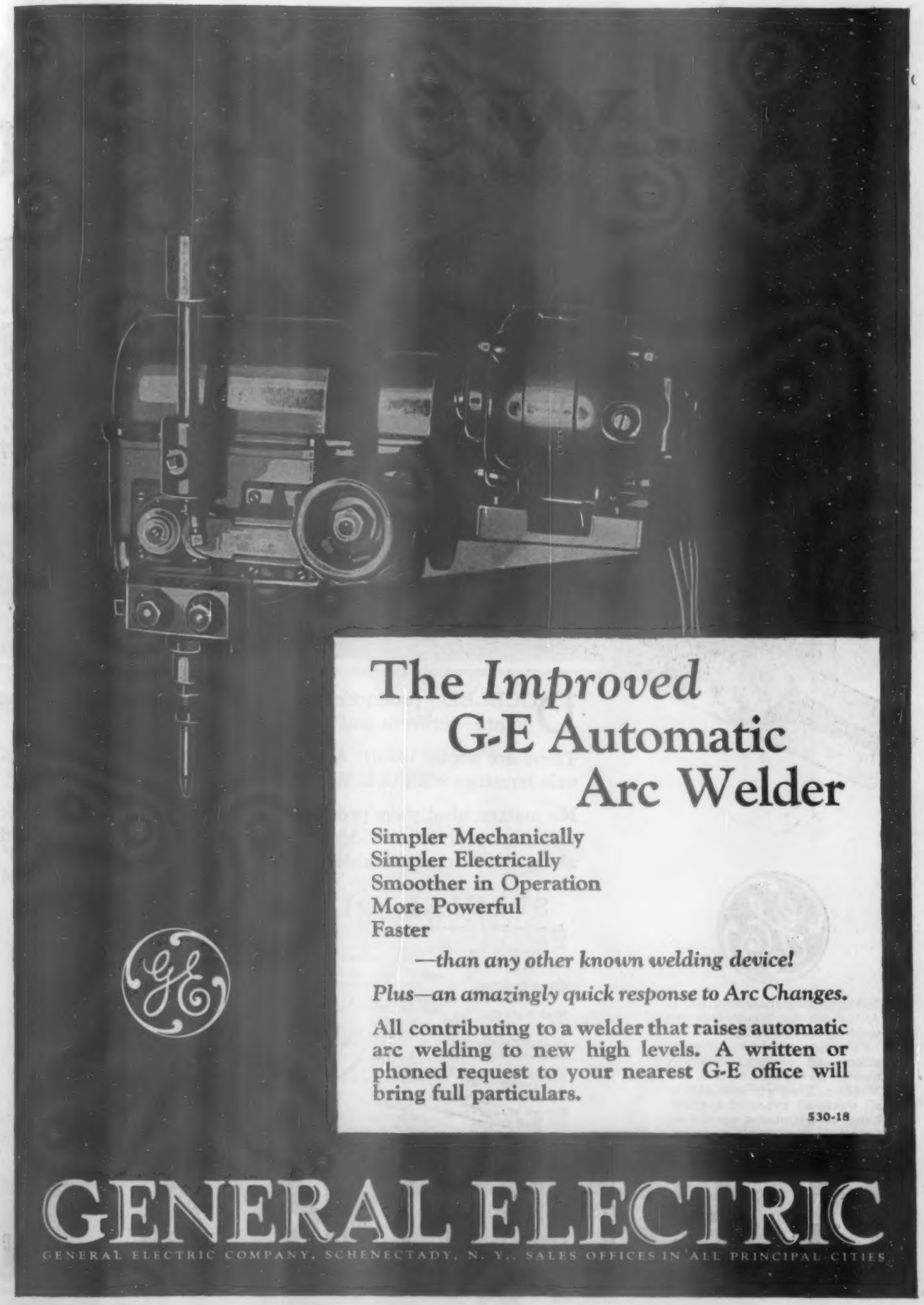
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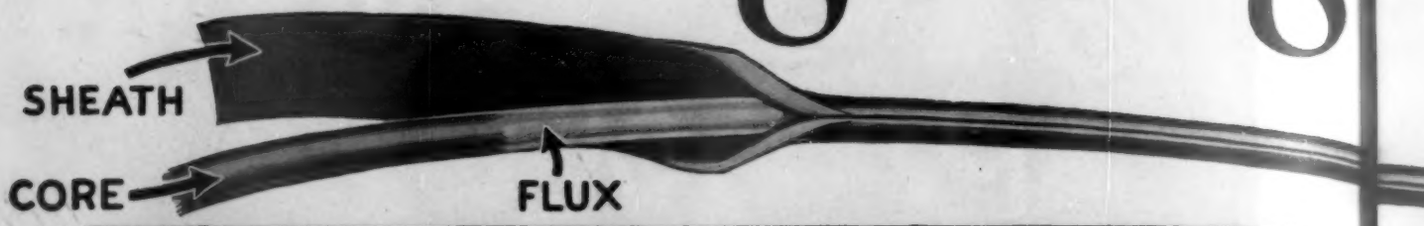

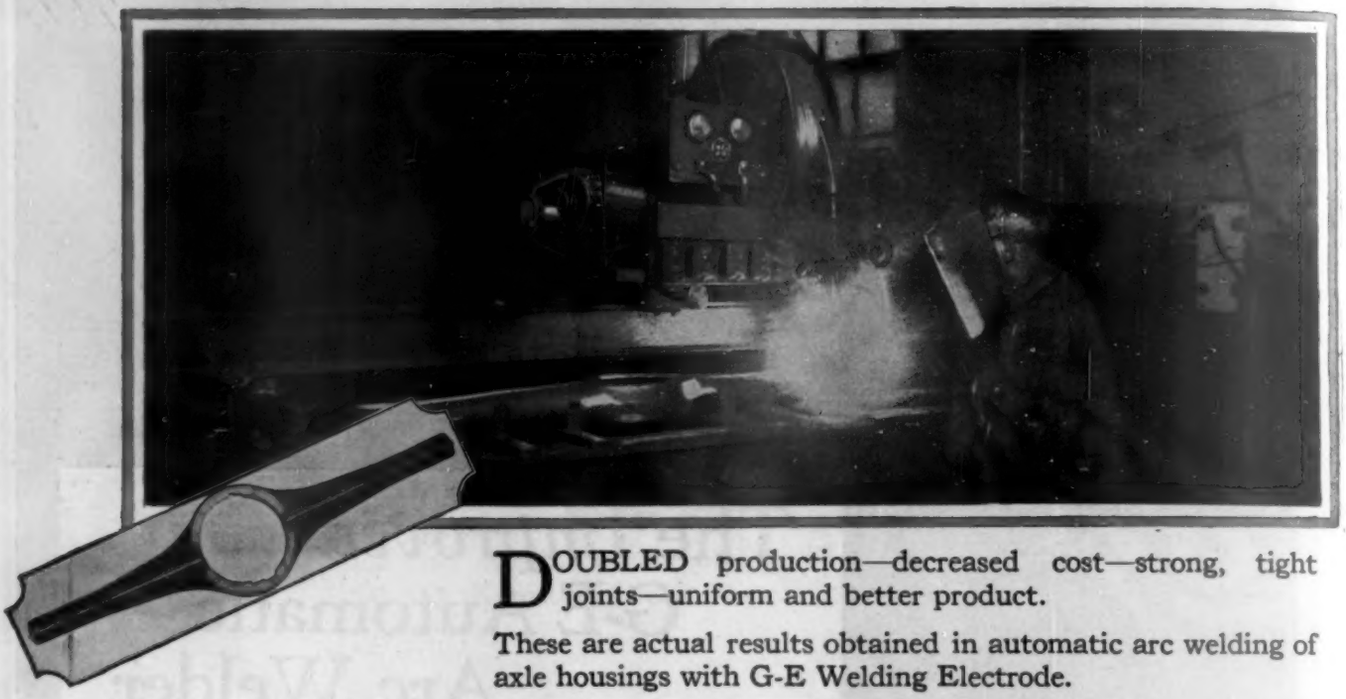

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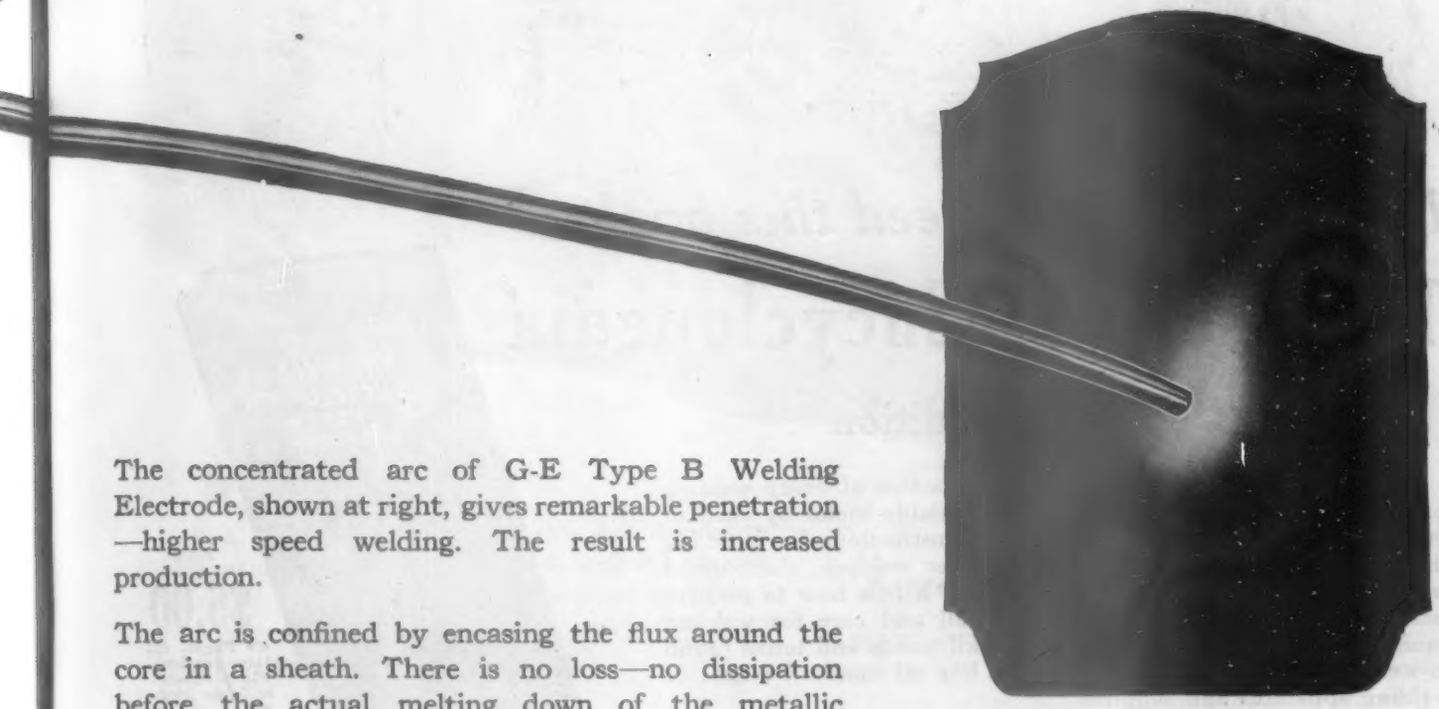

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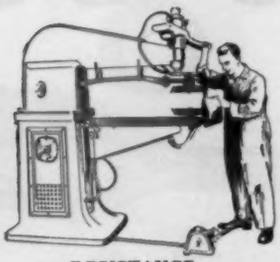

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†*Green Bay—Universal Oxygen Co.
†Kenosha—Wisconsin Oxygen & Hydrogen Co.
†*Madison — Universal Oxygen Co.
†*Manitowoc — Universal Oxygen Co.
†Milwaukee—Universal Oxygen Co.
†Sheboygan—Universal Oxygen Co.

*Signifies Warehouses.
†Plants and warehouses indicated can supply Hydrogen.

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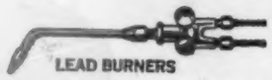
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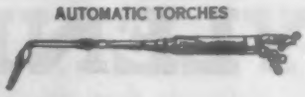
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EDITORIAL

The Buffalo Meeting

FAIRLY complete reports of the Fall meeting of the American Welding Society at Buffalo, and the exhibition of welding equipment and welded products which accompanied it, have already been published in advance of the meeting, so it is scarcely necessary to devote additional space to further reports of the meeting in general.

The attendance on the part of non members was somewhat limited, probably on account of the extremely unfavorable weather conditions, but the interest of those who did attend was unmistakable. The show in the Auditorium was everything that could be desired by anyone who was interested in the progress of the industry. To have assembled under one roof so many exhibits to illustrate the possibilities of welding was a real inspiration. The visitors freely expressed their amazement at the potential power of the welding industry as indicated by the big display of its present accomplishments. The exhibition of typical welding jobs in the center of the floor was convincing proof of the dependability of welding, and also of its adaptability to every problem concerned with the joining of metals. The men who undertook to manage the show at Buffalo did their work well and evidently received some splendid co-operation locally.

A particularly significant move was made in the course of the meetings when it was decided to organize a new committee to work on specifications of welding wire. Many of those in the industry who are interested in this subject have felt for some time that the present specifications could be made more complete and more useful to the industry, but it naturally required a considerable amount of discussion to decide upon a program of further research. Meanwhile other subjects in connection with welding problems have received constant attention with beneficial results to the processes involved. It is quite certain that the newly appointed committee will be able to accomplish real things in their part of the general program in welding research. The proposal certainly received an enthusiastic send-off at the Buffalo meeting. The industry can anticipate an investigation which will be free from prejudice, and thoroughly honest about hastening the solution of the problem involved in the selection of filler material. The subject is such an important one that if this task is carried out as faithfully as has been promised, the result will be worth all of the effort which has been devoted to promoting the interests of the society during the past year.

In the course of the week which was spent at Buffalo, there was an informal meeting of men especially interested in the subject of resistance welding where several subjects pertaining to the welfare of this branch of the industry were discussed freely in an informal way, giving those present at the gathering a better understanding of each other, and also of their common problems. This little incident is mentioned here, not because any significant action was taken, but because it suggests the value of close acquaintance between competing interests. A thorough analysis of the welding industry would undoubtedly disclose a great many possibilities for stirring up interest in memberships, and interest in society activities through the organization of informal group meetings which would bring together men who have common problems. In many cases it would be safe to leave the program of such meetings entirely to chance, trusting to close contact to strike the spark of interest.

Altogether the meeting was such a pleasing and interesting one that probably all of us who attended felt inclined to boast how successful it was. Certainly no one could attend without feeling an industry as young as ours is entitled to boast for being able to show so much to the engineering and industrial public. However, these comments are made more for the purpose of suggesting that we do not forget one very striking lesson: that there is a world of unworked opportunity to be developed by co-operative action on the inspirations received at Buffalo.

Incidentally, the industry owes a vote of thanks to Buffalo for its splendid hospitality.

How Strong Is a Weld?

SEVERAL times recently the suggestion has been made that the best way to answer this question is to say that there is nothing to prevent making the weld stronger than the parent metal. In some cases where this result cannot be accomplished by skillful operation alone it can be accomplished by careful selection of filler material which will deposit stronger metal in the weld. The cost of welding rod which occupies only a small fractional part of the complete job is ordinarily such a small portion of the total cost that the additional cost of special filler rod or welding wire pays for itself in the quality of the result secured. This is especially true in cases where the use of better filler material is the best means of securing a weld of the desired strength. And as long as there seems to exist any doubt regarding the possible strength of a welded joint it is certainly going to be worth while to recommend using materials which will easily demonstrate the possibility of making the weld the strongest part of the assembly.

Prof. Adams' Paper

ONE of the most valuable contributions that has ever been made to literature of welding was the paper read by Professor C. A. Adams before the meeting of the Iron and Steel Institute, entitled "Welding of Iron and Steel." For the benefit of those who have not had the privilege of reading this paper, it should be noted that it is not in the nature of process instructions, but rather a survey of the possibilities and limitations of the four processes of fusion welding, and a discussion of some of the applications which illustrate the real value and dependability of welded joints. Engineers who have only a vague idea of what welding is or whose knowledge of welding is perhaps limited to a single process can really obtain from this scholarly treatment of the subject an idea of the real truth about welded joints. A limited supply of reprints of this paper is available at the offices of the American Welding Society of New York City.

Comfort Aids Workmanship

WHEN complaints regarding working conditions are encountered it is sometimes difficult to tell offhand whether the employe is simply cranky or honestly trying to give himself to work to better advantage. However, working conditions are always worth investigating because good welding is a rather painstaking job and comfortable surroundings always encourage continuous operation. Ventilation is one of the subjects which occasionally calls for conversation along these lines. The story of long welds made on the inside of tanks or large diameter pipes indicates that it is possible to do work under adverse conditions, without showing how much better work and what a better rate of protection the men who do these difficult jobs can accomplish where they are able to work more comfortably. The danger lies in assuming that because a job can be done in a certain way that way is the best way to do it. One welding supervisor who was interviewed recently carries the idea of comfort to quite an interesting degree. He makes it a rule to make no comments on the operator's work while he is on the job but to save all conversation, criticisms and suggestions for the end of the work period when the welder's mind is not concentrated on the matter of getting fusion and penetration. The answer is that his plant turns out work of which the whole welding industry is proud.

Square dealing built Linde's reputation

IN THE emergencies of the last fifteen years —and there have been emergencies of many kinds—the spirit of a business house has had many opportunities to show itself.

Were the customers' rights protected? Or were excuses delivered instead of materials, and customers left to look out for themselves?

Linde's reputation with its customers during all these years is one of which the company is justly proud. The rights of the customer have always been paramount.

As a Linde customer you are sure of your oxygen supply, not only in times of plenty, but in times of emergency as well. It is guaranteed by 37 Linde plants, 105 Linde warehouses and by the Linde principle of giving the customer a square deal.

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OXWELDED PIPE FITTINGS are extremely successful and their flexibility recommends them to the average plant man. The Linde Procedure Control on oxwelded pipe fittings gives detailed instructions and is especially valuable on obscure points which enter vitally into the ultimate success of the operation.

Efficiency From Welding Machines

Some Considerations Involved in Getting the Most Out of Every Welding Machine Tool in the Automotive Industry

By J- W. Meadowcroft*

WHEN we consider the way automobile manufacturers are constantly forced to change the models of their automobiles to satisfy the buying public, one must not forget that most important item of tooling up for production and the expense involved.

In the past, many engineers were sold to certain lines, which, when incorporated, necessitated a certain line of welding machine tools. These, when purchased, represented a large investment, but they were necessary to meet with the new construction. Though the advisability of buying so many new tools was questioned by the directors of purchasing, due to the tremendous cost involved and to the fact that so many standard fixtures were in stock, they were overruled by their superiors and the change was made accordingly.

J. W. Meadowcroft.

As a general rule, when new, specially designed welding machines were purchased for the production of new models as mentioned above, they were used, regardless of whether they were the most economical or not, as their purchase represented such a very large amount of money, and a change involved such a very heavy loss and hold-up in production, that the management would not tolerate it.

The more modern and up to date engineer, when starting to design a new model today, refers to statistics which are built up by the welding engineers and shop men, and with this information he is guided in his future design so that the welding machine tools which have such a long life can be used to advantage, both from an economical as well as a productive standpoint. This type of engineer also endeavors to eliminate all inner construction changes possible, and lays much stress on the outer construction, as this is what the buying public is so vitally interested in. He also consults the purchasing agent, welding engineer, and shop men on all items of vital importance, so that he can assure the management of real economy in the purchase of welding machine tools, as when welding machine tools of a standard design are used, the shop man takes advantage of all repair parts, saving the expense in maintenance. He also lays out the work in such a manner as to be able to take advantage of every available welding machine tool which he is thoroughly familiar with and which will produce a commodity that is a credit to the company which manufactures and sells it.

The more modern engineer is kept in touch with all new welding machine tools so that in cases where it is necessary to add to the present equipment, he can be guided according to this necessity. However, the welding engineer keeps both the purchasing director and engineer advised as to the possibility of all the new features which the welding machine tools have, which are worked out by the welding machine tool manufacturerers.

The welding engineer also checks up the many standard accessories which are applied, in many cases, to welding machine tools by various manufacturers and sees that same can be used to just as good or greater advantage on the new welding machine tool. This is a matter which must be decided by the welding engineer, as he is constantly guided by his production, and cost of maintenance to welding machine tools which is forwarded to him monthly by the management. He is constantly working to eliminate this expense by having improvements made in welding machine tools, and he never fails to notify the director of purchases of the many conditions which arise from time to time, which involve expense in maintenance to the company. The director of the purchasing division, in turn notifies the proper representative of the welding machine tool company who immediately calls on the welding engineer to take care of his complaints and makes arrangements to improve tools as per suggestion of the welding engineer so as to get the most efficient results from the welding machine tool in which he is interested. In this manner, all concerned are kept in touch with the situation and thru this medium, changes are constantly being made by the manufacturers of welding machine tools and also the users. It is thru this procedure that the best results are obtained, as it is generally necessary for the user to make changes from time to time to accommodate conditions which cannot be anticipated by the welding machine tool manufacturer.

A number of years ago, a large automobile company found it was necessary to purchase a very expensive welding machine tool, due to change in design, and the parts to be produced were to be manufactured in large quantities at a low cost and the welding machine tool was an excellent tool. However, it was never used for this particular item, and it became a shop problem, and a very difficult one to solve. The tolerances necessary, previous to assembly in this welding machine tool, were impossible to get, due to the pieces being drawn sheet metal

*General Superintendent, Edw. G. Budd Mfg. Co., Philadelphia.

stampings which could not be machined economically and still retain the strength necessary to stand the stress which would be placed on them. Yet at the time this tool was ordered and purchased, it was thoroughly understood by all concerned that they had a real problem on their hands. However, as the welding engineer, engineer, and purchasing director were following this item closely due to its importance, they soon found a new assignment for this tool, by change in construction. This would not have been successful, but for this cooperation of our more modern engineer who is constantly working to procure the highest efficiency from each welding machine tool.

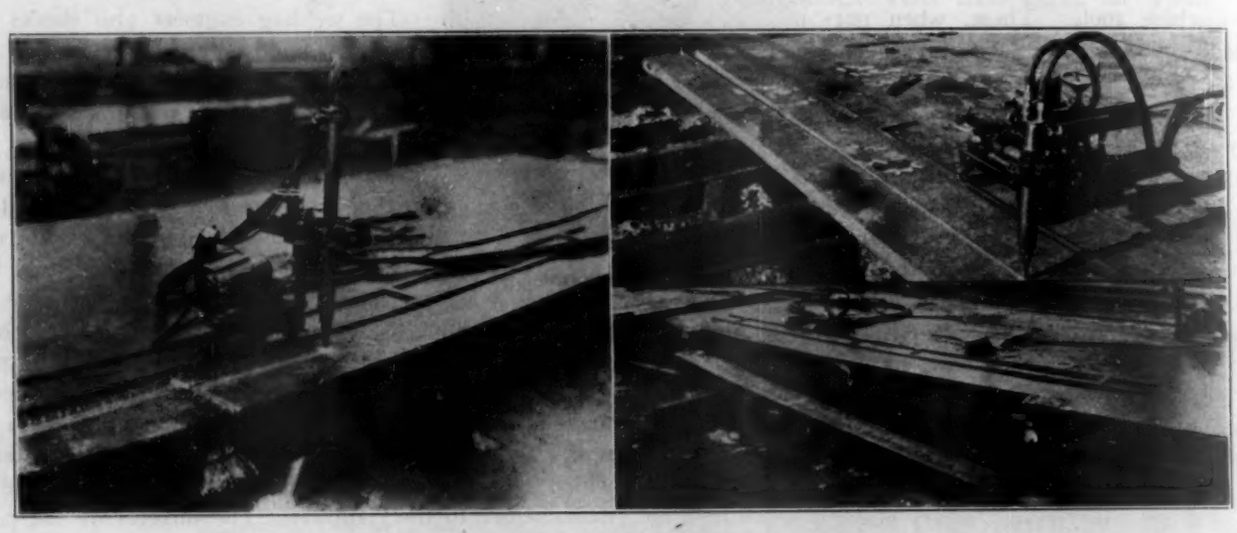
CUTTING WITH ILLUMINATING GAS

The high efficiency of the gas cutting torch as compared with other methods of cutting steel has encouraged many of those who are interested in the development of apparatus for this purpose to experiment with different kinds of fuel gas, so as to increase the total efficiency of the process as far as possible by reducing the cost of the gas used for fuel in the cutting torch. The use of city gas, or illuminating gas, has been tried successfully in a number of instances where the conditions were favorable to its use, and special cutting torches have been developed for the use of illuminating gas for cutting. During the past year the Alexander Milburn Company of Baltimore, Maryland have placed on the market two types of torches for use with city gas, one of which is fitted with a super-heater that is incorporated in the body of the torch and which acts to heat and expand the cutting oxygen prior to combustion. The second type does not preheat and expand the oxygen but uses the gas with ordinary line pressure. The latter torch is intended for use in small industrial plants where there is a great deal of silver soldering, brazing and reclamation of small castings.

Particular interest has been shown in the city gas cutting torch with its device for preheating the oxygen because of a series of tests recently performed to show the increased efficiency obtained by preheating the oxygen. There has been considerable debate regarding the relative merits of different proposed plans for increasing the efficiency of gas cutting, and since there is such a marked difference of opinion, further studies will undoubtedly be made for the purpose of clearing up disputed points. They will probably result in the accumulation of new and useful information on gas cutting.

A few photographs taken in the course of a cutting test in which city gas was used for the fuel are reproduced here, and in this connection it might be well to mention some of the points raised in favor of the use of city gas. In plate cutting it has been found that a sharp edge is maintained along the face of the cut, with a notable lack of metallic slag on the underside of the cut. The oxygen preheating device is said to reduce the oxygen consumption from 25% upwards and also to reduce the weight of oxygen lost in preheating the mechanical work. It is also pointed out that the saving of oxygen becomes greater when the work involves high rates of oxygen flow.

The illustrations show both types of torches in use on a plate cutting machine. One shows a low pressure type without the preheater and the other shows the high pressure type with the oxygen preheating device in use. The third photograph shows the clean, sharp cut which is obtained. These photographs were taken in the course of a test which was conducted early last month. The cost of cutting 100 lineal feet was $2.83 for 6¾ inch plate, $1.25 for 4 inch plate, 57c for 3 inch plate, 36c for 1½ inch plate and 19c for ½ inch plate. It was found that the machine would cut in one hour 23 feet of 6¾ inch plate, 28 feet of 4 inch plate, 34.6 feet of 3 inch plate, 40 feet of 1½ inch plate and 70 feet of ½ inch plate.



Demonstrations of Cutting with Illuminating Gas.

WELDING AT THE POWER SHOW

In completeness, novelty and attendance, the Fifth National Exposition of Power and Mechanical Engineering gives promise of far out-distancing its predecessors, according to reports received from our representative at the show as this issue is being prepared for the press. The exposition contains over 500 exhibits and occupies over 160,000 square fet of floor space in the Grand Central Palace. The welding industry is represented by the following firms:

The Welding Engineer, General Electric Co., American Brass Co., Joseph Dixon Crucible Co., Oxweld Acetylene Co., Linde Air Products Co., Mueller Brass Co., Harms & Co., Air Reduction Sales Co., Wilson Welder & Metals Co., Westinghouse Electric and Mfg. Co., Torchweld Equipment Co., Vulcan Electric Brazer & Welder Co., Moto Meter Co., Haynes Stellite Co., Scovil Mfg. Co., Ingersoll-Rand Co., Lincoln Electric Co., International Nickel Co., Sherwood Mfg. Co.

Also, a part of the motion picture program at the Power Show was a film entitled "Oxygen—The Wonder Maker," shown by the Air Reduction Sales Co. Many of the exhibitors are showing products which have been made by welding and some of them also supply welding accessories.

The attendance was over 100,000, or about 30% above last year. Over 500 pieces of literature, including copies of *The Welding Engineer*, were distributed from the booth of The Welding Engineer Publishing Co.

NEW APPOINTMENTS TO UNION CARBIDE BOARD

The election of W. F. Barrett to a vice-presidency and the election of G. W. Mead to membership on the Board, was announced by the Union Carbide and Carbon Corporation following a meeting of the Board of Directors of the corporation at New York on November 23rd.

Mr. Barrett, the new vice-president of the Union Carbide and Carbon Corporation, began his association with the subsidiary companies of the corporation in August, 1913, when he became Works Manager and Chief Engineer of the Linde Air Products Company.

In January, 1918, Mr. Barrett was elected vice-president and a member of the Board of Directors of the Linde Company and from that time on his progress in the official family of the subsidiaries of the Union Carbide and Carbon Corporation was rapid. After his election to the presidency of the Linde Company, Mr. Barrett became vice-president and then president of The Prest-O-Lite Company, Inc., Dominion

W. F. Barrett.

G. W. Mead.

Oxygen Company, Ltd., Prest-O-Lite Company of Canada, Limited; Union Carbide and Carbon Research Laboratories, Inc., Carbide and Carbon Chemicals Corporation and Glendenin Gasoline Company.

He is still president of all of the above named companies and corporations and, in addition, is a director in National Carbon Company, Inc., and Oxweld Railroad Service Company.

Mr. Barrett also is president and a member of the Board of an outside corporation known as Niacet Chemicals Corporation.

A graduate of the Scheffield Scientific School, of Yale University, with the degree of Bachelor of Philosophy, Mr. Barrett, began his engineering career as a levelman and rod man with the Buffalo, Rochester and Pittsburgh Railway, at Bradford, Pa. In 1905, he joined the Ogden Gas Company, at Chicago, and two years later that company was consolidated with the Peoples' Gas Light and Coke Company. With this company, in 1913, when he resigned to join the Linde Company, he had risen to the position of Assistant Chief Engineer.

During the World War, all the companies with which Mr. Barrett was associated were engaged in war work and carried on a great deal of construction to meet war demands and to assist the Government in its war program. Mr. Barrett personally was a member of several special war work and advisory committees and put in the greater part of his time at Washington assisting the Government in an advisory capacity on gases, offensive as well as oxygen for aviation, welding and other purposes. At various times during the war he assisted the Chemical Warfare Service, Ordinance, Aviation Branch Signal Corps, Navy, War Industries Board and other divisions of the Government's wartime organization. He had charge of design, construction and operation of the U. S. Government Helium Producing Plant for Army and Navy dirigible and balloon work at Fort Worth, Texas. This plant, under his direction, was designed by the Linde Company and up to the present has been the only successful plant for the purpose.

In recognition of this work, the University of Pittsburgh conferred the honorary degree of Doctor of Science on Mr. Barrett in February, 1925.

Mr. Barrett is a member of the following technical societies: American Society of Mechanical Engineers, Society of Automotive Engineers, American Chemical Society, American Society for Testing Materials, American Gas Association, American Association of Refrigeration. He is a resident of New York City and a member of the University Club, Apawamis Club, American Yacht Club, Yale Club of New York City, Uptown Club and Manursing Island Club.

Mr. G. W. Mead, whose election to membership on the Board of Directors of Union Carbide and Carbon Corporation, was an important action of the Board meeting on November 23rd, has been identified with subsidiaries of the corporation since 1906, when he was elected the first secretary of the Union Carbide Company. In 1912, he became president of The Linde Air Products Company, in which position he served until he was succeeded by Mr. Barrett in 1925. In this company, Mr. Mead then became chairman of the Board of Directors, which position he still holds.

For a number of years Mr. Mead was secretary of Union Carbide and Carbon Corporation, and from 1917 to 1923, he was also treasurer and a vice-president of that corporation.

Mr. Mead now is a vice-president and director of Union Carbide and Carbon Corporation, a director of Carbide and Carbon Chemicals Corporation, president and a director of Carbide and Carbon Realty Company, Inc., a director of Electro-Metallurgical Company, Chairman of the Board of The Linde Air Products Company, a director of the Michigan Northern Power Company, a director of National Carbon Company, Inc., a director of Oxweld Railroad Service Company, and a director of The Prest-O-Lite Company, Inc.

LARGE CASH PRIZES OFFERED FOR ARC WELDING PAPERS

According to newspaper stories which have just appeared, Mr. Charles M. Schwab, president of the American Society of Mechanical Engineers has announced that a number of large cash prizes will be awarded during the year 1927 for the best papers submitted to the Society on the subject of arc welding. The report states that the Lincoln Electric Company of Cleveland, Ohio, have offered these prizes, consisting of a $10,000 first prize, $5,000 second prize and a $2,500 third prize, making a total of $17,500. It is said that these papers will be received from all countries of the world, so that the competition is not confined to the United States. These prizes certainly offer a wonderful incentive for the close study of the subject of arc welding.

NEW SHAWINIGAN BOOKLET

The Shawinigan Water & Power Company, of Shawinigan Falls, Quebec, has prepared a beautifully illustrated sixty-eight page booklet which outlines the expansion of the company in the last twenty-five years. Airplane views and interior views, in several colors, show the extent of the works in the vicinity of Shawinigan Falls, including the carbide plant whose products are sold by the Shawinigan Products Corporation, of New York City.

Bronze Welding Applications*

Better Knowledge of Correct Technique Has Resulted in Rapid Extension of Use of Bronze Welding Rod in Repair and Production

By W. C. Swift†

THERE are other qualities in a weld highly desirable at times in addition to strength. This was exemplified in a recent application of bronze welding brought to my attention last week by a railroad welding supervisor. Their galvanized iron telephone line had got in such a bad condition it was most difficult to hear anything over it so they replaced the old joints with bronze welded joints. They can now hear over this line with great distinctness. Careful tests made of these welded joints by leaving them in acid solutions showed that the zinc coating of the wire adjacent the welds was uninjured by the welding and that the only possible disadvantage might be a slight annealing of the wires near the welds and, if such is the case, it has not yet given any trouble.

A further example of the desirability at times of other qualities in welds than just strength is the increasing use of bronze in locomotive, truck and other repair shops for coating steel parts subject to corrosion and pitting thereby giving these parts a life sometimes three to four times as long as when uncoated. This goes to show that this use of bronze welding should become more general and should be made at time of fabrication instead of waiting until corrosion and pitting had begun.

A still further use of bronze welding for other than strength only is the coating of locomotive, truck and other machine parts where steel or cast iron will do more or less rubbing in operation. A thin layer of bronze is welded onto the surface of one of each two parts that rub and wear. It seems that it would be highly desirable if this also were done at the time the machine is fabricated instead of waiting until the parts are badly worn.

Locomotive shop superintendents state that worn cast iron or steel parts built up with bronze frequently wear three or four times as long as new uncoated parts and that they are seriously considering coating the lower halves of new locomotive pistons with bronze before putting them into service.

It would seem therefore that those interested in the promotion of welding should be on the lookout for opportunities of welding onto steel bronze coatings to resist rust corrosion and wear and to reduce friction and electrical resistance. The extension of bronze welding throughout these fields would develop in time hundreds of new welding applications.

Tobin bronze welding is rapidly moving forward to occupy a very prominent part in this highly important art. Whenever reference is made to the process of jointing cast iron, steel, copper and copper and nickel alloys with the oxy-acetylene flame and bronze rods, it is called, "Bronze Welding," in contra-distinction to the process of jointing these metals by brazing, i.e.—by placing the parts together and covering the joint with a brass spelter mixed with flux and heating the parts until the spelter melts and fills the joint. Literally miles of brazing is done daily in the manufacture of brass and high carbon steel pipe and no one would think of calling it welding.

In each of these processes, the jointing material is very similar and the joint is affected with the parts at a red heat only, and, for these reasons, there are many who are ready to argue that each should be called, "brazing." However, in cases like this, custom seems to rule and the term, "Bronze Welding" is now understood by all having to do with welding to be the process of making a joint by heating clean weld areas of the base metals to a red heat only and then melting the fluxed end of a bronze rod onto the heated areas and continuing until the "V" is filled or a bead of correct width and height deposited.

In bronze welding, brazing and soldering, the same principles govern. The weld areas must be clean and must be heated to a temperature corresponding to that of the jointing material when completely melted and, under these conditions, there are few metals or alloys but that will "surface-alloys" instantly to a slight depth and with the correct temperature continued for any appreciable time, this alloying action will continue to a measurable depth, as can often be seen by sectioning and examining with a microscope.

It is this action of metals and alloys that makes the bronze weld, braze or joint. It is essential that the weld areas be clean and at just the right temperature as before stated for, if too hot, the bronze will burn or dezincify, and if too cold, the bronze will lie on the surface of the weld area without alloying with it. Learning just the right heat the weld areas should have when the bronze is deposited puzzles many welders, for "dull red" and "cherry red" seen with the naked eye and through welding goggles and through cutting goggles vary many degrees. It seems to be a cause of the welder having to learn by practice the correct heat for the weld areas as seen through his own welding goggles and then remembering it. However, an experienced welder during the progress of making a weld instantly notes whether his weld areas are too hot or too cold and governs the direction of his flame accordingly.

The advance in the use of bronze welding among the job shops is steady, but not so rapid as in the railroad repair shops, and it is rather puzzling just why this should be so, having the very great advantages it does in the welding of much of the work. A careful check made over a considerable period of time of the work brought into a welding shop doing automobile, truck, farm machinery, factory and household welding, where the welder was equally at home in welding with either steel, cast iron or bronze, showed that bronze welding was used advantageously in making 75 per cent of the repairs.

The use of bronze welding increases more rapidly in those shops where the owner does the welding than in the shops where the welding is done by employes only. And sometimes even the owner of a shop will remark that he does not welcome the advent of a process that will eventually result in reduced charges for making certain welds. However, time has clearly proven that the introduction of new machines and methods always in the end benefits the workman though it may temporarily reduce the amount of work to be done.

It is also to be noted in connection with the "seemingly slower than it should be" advance in the use of bronze welding in job shops, that a welder welding steel with steel rods and cast iron with cast iron rods can proceed with his welding with less care and with less danger of burning the weld metal than when using bronze filler rods and it is also observed that it is always the careless rough workman who greets you with the announcement that he knows how to weld steel with steel and cast iron with cast iron and therefore does not have to learn how to use bronze.

Just such an announcement was made to the speaker by the proprietor of a large welding shop one day in February of this year, and just as he made it, a truck brought into his shop a large cast iron pulley with a section of the rim broken out. It would have been a two hour job for a good bronze welder to have had the broken section back in place stronger than it was when

*Paper read before the International Acetylene Association, Chicago, November, 1926.

†Research Engineer, American Brass Co., Waterbury, Conn.

new but this welding shop made a three day job of it and charged accordingly. The owner of the pulley was moved to remark that hereafter he'd see to it that he had a spare on hand for everything in his plant that could break.

If a welder can use bronze in repairing a break in cast iron, he should do so as the weak spot is then replaced with a metal having two to three times the strength of that which broke and yet that is ductile and will accommodate itself to any slight movement that would tend to put a brittle metal of low tensile strength under a dangerous strain.

An interesting use of bronze welding that is being noted more frequently of late is where large plants consisting of several buildings are supplied with steam at 200 to 250 lbs. pressure through 6 in. and 8 in. diameter steel pipes united with cast iron flanges. Bronze has proven the ideal material, in fact the only possible material for welding the pipe ends to the flanges and the engineers of two large plants so equipped have told me they have never had any leaks although the welding was done several years ago.

That is an illustration of another very great advantage bronze has in welding, as with bronze it is possible to unite steel, malleable iron, cast iron, copper and high-copper alloys in any combination with a joint having approximately the strength of a mild steel weld. As designers of machines become aware of this fact, there will be an increasing use of bronze welding. It will permit them to use just the material that should be used in any place to meet any special condition. And these metals can be welded without bringing the weld areas to a temperature higher than a dull red, at which temperature none of these metals is in any way affected other than possibly experiencing a slight annealing action.

Since bronze works well as welding material on steel, it is frequently asked why it is not used for welding steel pipe lines. A good bronze welder, but inexperienced on pipe welding made several bronze joints in succession on 8 in. diameter steel pipe at the rate of three an hour and the joints when placed in a testing machine on supports ten feet apart broke at an average of 8 tons each. A bronze welded pipe line would have a high salvage value as it would only be necessary to melt off the bronze and remove the pipe unharmed with the ends already "tinned" for the next weld.

However, during the past ten years many hundreds of good welders have been carefully trained to weld steel pipe with steel and a steel weld can be made under usual pipe line welding conditions without the necessity of being careful to have just the right heat at all times, and although in the making of the weld, one pipe section will pull out of line with the adjacent section, that is in a way a desirable condition to meet the changes of temperature between day and night and winter and summer. So while I think the welding of steel pipes will some day for some purposes be done with bronze, yet for the present we will see steel pipe largely welded with steel.

But in the fabrication of special parts such as manifolds, bronze can be used to great advantage as the steel pipe sections can be carefully fitted and assembled and then welded with bronze without any shrinkage and pulling out of line. Automobile engine manifolds, range boiler tanks and many other devices are fabricated from rolled steel and welded with bronze rapidly and excellently, but the use of bronze on the larger size tanks involves a problem of expansion and contraction as yet unsolved but surely not unsolvable, as a strong, ductile and rustless joint is greatly to be desired on these large tanks.

The great success of bronze welding of locomotive frames is one of the surprising and outstanding features of welding. There is no machine or engine part subjected to stresses more severe than those imposed on locomotive frames and such of these welds, as have been made by welders who understood the nature of bronze, have stood up surprisingly well. Several shop superintendents and locomotive foremen have reported no failures of bronze welds, after perhaps the first one or two made largely as an experiment, and frequently these have held.

Locomotive frame welds are made under almost ideal conditions for welding bronze. The sections run from 4x5 in. to 5x7 in. and at the break are "V" ed out vertically on each side and a piece of boiler plate ½ in. thick the width of the frame is set under the two ends. A welder on each side then brings the bottoms of the two ends and the plate to a dull red, heats and fluxes the end of a bronze rod and melts it onto the plate and against the heated frame ends and so continues until the "Vs" are filled. As the weld metal cools and shrinks, it draws tighter into the "Vs" and all the time the heat from the torch playing against the frame ends above the bronze holds the areas below already welded at the right temperature for a deeper alloying action to take place. The bronze already deposited in the weld is inaccessible to the direct heat of the torch flame, for as the weld is made it is against the sides of the welding "V" which, together with the hydrogen from the torch flame practically exclude the oxygen of the air from the molten bronze, thus reducing the burning of its zinc content to a minimum. These unusual advantages in the bronze welding of a locomotive frame are very great. Time cards covering these bronze frame welds show that the welding itself is usually done in from 33 to 55 minutes as compared with two to four times that long for making steel welds. These comparatively new and unusual uses of bronze welding follow along so rapidly one after the other that there is not time to test them in the laboratory and prove their worth, but merely to record them as what some user of bronze welding has done.

There is a very large and increasing use of malleable iron and its quality, uniformity and dependability are now at a high standard. As it is annealed at about 1650 degrees F. it can only be welded with bronze without destroying its valuable qualities, as bronze melts well under this annealing temperature and provides a weld comparable in strength and ductility with the malleable iron. Malleable iron and bronze welding therefore provide a medium most unusual in its advantages for the manufacturer wanting to put out a machine that will successfully meet rough, severe usage. And for those times when the irresistible meets the immovable and one of these machines does break, it is now an old story regarding the welder going out to the job with his gases, and a few pounds of bronze rods and his welding outfit and soon having the steam shovel, derrick or whatever it may be again hard at work.

It is, however, in the repair of broken cast iron parts that bronze welding has found its largest field. Because cast iron can be produced in the foundry with facility, shaped to meet almost any requirement, and is easily machined, it has the widest use in the manufacture of all kinds of tools and machines. It has, however, a very low tensile strength as compared with its compressive strength and it is the breakage of cast iron parts that has made perhaps the largest field for welding.

In welding cast iron with cast iron filler rods, it is necessary to heat the weld areas to a complete fusion and if the parts being welded have sections of unequal thickness or cross-connecting parts or are very large, owing to the nature of the cast iron, it is generally necessary to pre-heat the parts to a temperature above that at which expansion occurs and hold them at that temperature while making the weld and then carefully cover and let cool slowly to avoid cracking. But in the use of bronze in welding cast iron parts formed as described, extensive pre-heating can generally be avoided by heating the surface only of a few inches of the weld areas at a time to a dull red and melting on the fluxed end of a bronze rod, and then move to, another part of the break and similarly deposit a few more inches of the bronze, thus giving time for the heat absorbed by the iron at the place of starting the welding to dissipate; and so continue, being at all times careful not to put enough heat into the base metal at any one point to crack it. As it is the difference in temperature in a limited area that causes cracking, it is well even with bronze welding not to begin work on cold iron. If the job happens to be the repair of a cracked water jacket of an engine mounted in the car, drain off the water and run the engine until it is heated through before beginning welding. If the engine

block has been dismounted and is on the welding table, warm it generally with the torch flame before beginning work or, if there is convenient pre-heating oven, place the block in it until it is heated through. One welding shop doing a great deal of bronze welding of engine blocks has a small tank filled with water in which the block is placed and heated to the temperature of boiling water very quickly. But do not try to do bronze welding on a cold cast iron part that were it to be welded with cast iron rods would require complete pre-heating.

Next to iron and its alloys, copper and its alloys find the widest use in our industrial life. It has never been easy to weld copper with copper because, instantly it is melted, it is almost impossible to prevent some exidation. The production of copper sheets, tubes and rods deoxidized with silicon assist greatly in the successful welding of copper with copper. But if a slight difference in color of the weld from that of the base metal is no serious objection, copper can be very successfully welded with bronze, as the lower temperature at which the bronze melts permits making the joint with the copper base metal at a temperature considerably under its melting point, thus obviating the trouble from oxidation. And most of the bronzes and some of the brasses in common use have a copper content high enough to make welding them fairly easy with bronze welding rods. The copper-nickel alloys Ambrac and Monel Metal are also easily welded with bronze. A common example of the successful welding of copper with bronze is the repair of copper coils in water heaters, which is now done very generally all over the country.

One notes in going about the shops of our great industries and railroads serious welding problems involving various qualities of steels and intricate shapes of malleable and cast iron and there are hundreds even yet who though all that is required is a strong, ductile joint easily made with bronze, whether the steel be low or high carbon or the iron thin at one point and thick at the next, continue to study how to make these joints successfully with steel or iron with all their accompanying difficult conditions. Just when are they going to "wake up" to locomotive cylinders now in daily service welded with bronze 10 years ago, locomotives frames in daily service welded with bronze three years ago and miles of high carbon steel tubes that have been brazed daily for years with complete success.

All this is not just what might be expected under the title assigned this paper, but is an answer in a way to hundreds of letters received from welders during the past year.

And one further point that is giving many welders attempting to do bronze welding serious trouble should be briefly covered—all bronze rods will not make a weld. If you have tried to do bronze welding and failed, buy from a reliable manufacturer of welding equipment or gases or distributor of welding rods a quantity of Tobin Bronze (Trade Mark Registered) and a good brazing flux and try again and you will soon be bronze welding a surprisingly large part of all your welding with entire success and with all its very great advantages of time saving and strong, ductile and rustless welds.

THE WORKER'S HEALTH AND PROSPERITY

By Helena Lorenz Williams

There is no better provision for a long life and a prosperous one than disease prevention by means of good working and living conditions, nourishing food, and healthful rest and diversion. The modern sunshine factory building is good for the worker as well as for the employer, for it promotes efficiency an thus higher wages. In a book entitled "Health and the Workman," Dr. Lee K. Frankel, vice-president of the Metropolitan Life Insurance Company and chairman of the National Health Council, states that among the important factors that preserve and increase the health and efficiency of the worker are good lighting, careful ventilation, protection against dust and poisons, adequate washing and toilet facilities, and a plentiful supply of pure, cool drinking water.

The best lighting is daylight, but whether day or artificial light is used in the shop, there ought to be no glare. This can often be prevented by covering the electric bulbs with a shade so that the light beams cannot fall directly into the eyes. The shop should always be well aired, and the temperature kept around 68 degrees, if possible, by opening the windows occasionally, and keeping the air in constant motion. Where many people work together in one room, filtering devices, ventilators and fans are of great benefit in both winter and summer.

The common towel is one of the greatest dangers to good health. It is a means of passing on the germs of many kinds of infectious diseases to one's neighbor. But paper towels, that are used once and then thrown away, are both inexpensive and safe. The well equipped shop, of course, has both hot and cold water, so that the worker can scrub his hands thoroughly several times a day. Unfortunately, however, in many plants where these facilities are provided, the workmen do not use them as they should. Private dressing and locker rooms and adequate and properly located toilet facilities for both sexes, also help to prevent the spread of disease. Working clothes that can be taken off before meals and at the end of the day keep dust and dirt from getting on food and being swallowed, or from being carried home to the children and family.

Last year approximately 50,000 workers died in the United States of tuberculosis. A large percentage of these deaths might have been prevented by more healthful living and working conditions. The inhalation of dust, for example, still remains a source of danger to quarry, textile and many other workers. Lead poisoning is feared by painters, potters, glass workers, plumbers and others who must work with lead. Yet both dust and poisons can be guarded against. There are devices on the market that are so well constructed that they reduce these hazards to a minimum. Here again, however, the worker himself is too often neglectful. He is too sure that he will not "get it." Also, he disregards personal cleanliness, which is such an important factor in reducing the possibility of swallowing germs as well as dust and mineral particles.

Another essential to good health and physical resistance to sickness is good food. The amount and kind of food the worker should eat depends somewhat upon the type of work he does. But if his meals include plenty of green vegetables and milk, and meat not more than once a day, he is not apt to go far wrong. The important thing to remember in the matter of food is that every meal should be well balanced; that is, starchy foods such as rice, potatoes and spaghetti, for example, ought not to appear too often on the table at the same time. One of these, together with meat and such vegetables as spinach, kale, string beans, asparagus and beets, and fruits and salads, makes a good combination that is needed to make the body a well stoked and energetic machine. Variety of food is an absolute necessity.

Finally, the worker needs eight hours of refreshing sleep, and several hours each day for recreation or diversion that is totally different from his job. For example, the man whose job requires the constant use of his muscles needs to rest physically after working hours; but the man who sits still all day will be healthier if he digs in the garden, or walks, or takes some other outdoor exercise during his off hours.

The national, state and local tuberculosis associations in their campaign against tuberculosis, advocate a strong body as the best preventative against disease. Their nineteenth annual sale of Christmas seals, which finances their educational and relief work, will be held throughout the country in December. You are invited to share in this great life-saving campaign by buying Christmas seals.

Fields for Production Welding*

Superiority of Welded Construction Over Castings Offers Every Welder an Opportunity to Increase His Earning Power

By R. E. Kinkead†

Welding a New Engineering Practice

MECHANICAL engineering has had to go through a very radical evolution since welding and gas cutting have become practical shop methods. Two of the most important things we do in mechanical engineering have been greatly effected by the widespread use of welding and cutting. The mechanical engineer today who does not understand these two metal working methods is as hopelessly handicapped as if he did not know the multiplication table.

The two fuunamental problems I refer to in mechanical engineering, which have been so strongly effected by welding and cutting are:

1. Getting metal into a predetermined shape.
2. Fastening pieces of metal together into a predetermined assembly to make a piece of machinery or equipment.

Whether one undertakes to build a steam locomotive, an electric farm lighting outfit, a printing press, or a kitchen stove, these fundamental problems must be solved.

Great industries have been built up on the strength of people's idea of the proper solution of these problems. For instance, the whole foundry industry of this country is founded on one idea of how to get metal into a predetermined shape. Gray iron, steel and malleable foundries exist to solve this problem. Now a whole set of industries are founded on an idea of how to put pieces of metal together in an assembly. Take for instance the matter of rivets and bolts. Great plants in this country do nothing else but make bolts. Back of those plants are other plants which make nothing else but automatic machinery to make bolts.

The point I wish to make is, that the problems with which welding and cutting deal, are fundamental mechanical engineering problems which underlie the manufacturing industries of this country. I want to also make the point that no process ever introduced in this country, ever produced such sweeping changes in industry, as welding and cutting are about to make.

Operation and Economic Law Forces Use of Welding

The reason these changes are taking place now, and will take place at a tremendously increasing rate from now on, is, that welding and cutting have introduced a BETTER means of doing the work, and a method which is TREMENDOUSLY CHEAPER. The operation of economic law makes it necessary to adopt methods which are better and cheaper. New manufacturing institutions are forging ahead to financial prosperity, because they have in this respect aligned themselves with the operation of economic law. Great manufacturing institutions whose managements have fallen into mental ruts from which they cannot rise, will inevitably fail and be wiped out of existence. Economic law does prevail. You may evade the Prohibition Law, but no one has ever evaded the operation of economic law. Ignorance of the laws of economics will not mitigate the penalty for disobedience, any more than ignorance of the law of gravity will mitigate the penalty for jumping out of an airplane without a parachute.

Here is what this new mechanical engineering practice of using welding and cutting enables us to do. We can take hot rolled steel, which costs around 2c a pound, get it into the proper shape, and fasten it together by the use of welding and cutting for ½c to 1c per pound. Let us say that the equivalent of a rough gray iron casting costs 3c a pound. Owing to the superior strength and stiffness of steel, we only have to use half as many pounds as if we were using cast iron. Therefore, a 100 pound casting which costs $6.00 may be reproduced in welded steel for about $1.50.

Now let us see how that works out as a business proposition. Suppose a machinery builder is making a machine which has 2,000 pounds of gray iron castings on it, which may be reproduced in welded steel. At 6c a pound the rough casting would cost $120.00. Another machinery builder starts up to build the same machine from welded steel. The same piece costs him only $30.00. This difference of cost appears in the ratio of at least three to one in the selling price. The manufacturer using the gray iron castings will therefore have to sell his machine for at least $270.00 more than his competitor, if he is to break even with him. Now there are not very many standard machines which sell for more than 30c a pound. Gas engines, pumps, compressors, machine tools, etc., sell on the market for less than 30c per pound as a general proposition. At 30c a pound the manufacturer would get $600.00 for his machine made of gray iron castings and weighing 2,000 pounds. His competitor using welded steel can sell his machine for $270.00 less and make the same profit. His competitor's price would be therefore, $330.00. Other things being equal, who will get the most business? You may not think you know much about the operation of economic law, but if you know the answer to this question, you know a good deal about it.

Cashing in on Your Knowledge of Welding

I suppose that I shall be severely censored by the intellectual giants of the engineering profession, if I, an engineer, say to you, that you can make a lot of money out of showing people how to build machinery out of welded steel in place of gray iron castings. Engineers are not supposed to talk publicly on the subject of making money. From the high power engineering viewpoint, that is a very vulgar subject.

But I will try to bear up under such criticism as may be directed at me for talking to you on the subject of making some money out of your welding knowledge.

If you want to make some money out of a proposition, don't wait until everyone else knows about it before you start. That holds whether you are buying real estate, stocks and bonds, or anything else which you do with the expectation of profit. Take radio, for instance, if you expect to be anybody, get anywhere or make any money out of radio, you should have started about five or six years ago. Every one knows that radio is a good thing now. The fellows who cashed in on it knew it five or six years ago, and that same principle holds in the welding industry. If you want to cash in on your knowledge of welding today, don't start into the tank welding business, everyone knows that it is a good proposition, and there is no money in it for beginners.

Welding Machinery Parts

Before welding amounted to very much in the commercial field, the steel industry took a very important step, the effects

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of which are now becoming apparent in the welding industry. Those steps were:

1. Organization of the Steel Corporation.
2. Mass production of standardized shapes and sections of steel.

The result of those two movements in the steel industry amounts to this: Steel today costs around 2c a pound, while cast iron costs around 6c a pound on the average. Steel is four times as strong as the best available cast iron, and is more than twice as stiff for the same section. This means that if you want to make a machinery base where stiffness is the determining factor, the material cost using steel, is one-sixth the cost of using cast iron. Welding offers a means of putting together the pieces of steel in such a manner as to get the desired shape of piece. The cost of welding together steel pieces is so low that practically the whole saving is effected due to the lower cost of the steel as compared with cast iron. Until electric welding became commercial, it was not possible to put the pieces of steel together to get the desired piece without using up all of the saving which had been effected by the use of steel in place of cast iron.

This situation is amazing. Steel which sells for 2c a pound was pig iron before it was steel. Yet gray iron castings, which are merely refined pig iron, cost around 6c a pound, and it takes four times as many pounds of pig iron to get the same strength as we have in steel.

Why does any one manufacturing machinery use gray iron castings? The reason is perfectly simple, and is the same that made tank builders rivet tanks together until the welding industry showed them how to make better tanks for less money by welding. Machinery builders do not know how to weld steel pieces together to reproduce rough castings in welded steel. If they knew how to do it, they would be doing it now.

Now don't forget gentlemen, that most of us do not readily agree that we do not know how to do anything. If you explain to the average machinery builder how the savings are made, and why they are made by using steel in place of cast iron, he will not fall on your neck and call you blessed. The chances are, about three to one, he will tell you that you are slightly demented, and say that if those things were true every one would be doing it. It is human nature to do that very thing. The man's trouble is, that he does not see how he can apply the method to his particular job, and until someone shows him, he will not budge an inch until something stronger than a lot of words hits him. Let one of his competitors do it, and whip him in the field a few times, and the machinery builder will come to you hat in hand and beg you to please help him do the job. That very thing is going to happen. The welding industry will not be able to furnish enough men to direct the welding operations along these lines. A good many men of intelligence and imagination in the welding industry, who are making $2,000.00 a year today, will be making $10,000.00 a year in five years.

Preparation for the Work

Now I am going to suggest to you how you can start getting ready to make $10,000.00 a year out of your welding knowledge. Start studying the machinery built by some machinery builder right here in your own town. Pick out a definite job to work on. A machinery base or frame is the easiest and simplest thing to go at first. Study out how you could take standard steel shapes, plate, etc., and weld them together to produce essentially the same piece. Next, check the design to see that you have given only equal stiffness. This will keep the weight down to about one-half the weight of the casting. Next, check the welding to see that you have not specified unnecessary welding to accomplish the purpose. Next, check the design to see that you have not done the job in an awkward manner, which penalizes you on the cost. When you get to the point where you are satisfied with the job, you are ready to show that machinery builder something. Remember, you haven't invested anything, you haven't spent a dime. All you have done is to put some of your welding experience down on paper where it is possible it may be worth a lot of money to you, as well as the machinery builder involved. Don't be discourgaged if nothing happens when the machinery builder sees your plan. Sit tight awhile, and you will find that he will come around looking for you.

There are twenty big machinery builders in the country right now who would welcome the opportunity to take on a first rate welding man with the intelligence and imagination to do this job for them, starting right now. As soon as the welding men appear, who will apply their talents to this job, every one in the country is going to want to do the same thing, and there will not be enough men to go around. But the fellows who get in on the proposition first are going to get into the $10,000.00 a year class first and quickly.

Please remember, that the suggestion I am making to you does not involve investing any money, does not involve learning a new business, but does involve staying up at nights for awhile studying how to apply what you already know.

High Power Technical Knowledge Not Necessary

I have seen good welding men who were afraid to tackle this proposition, because they thought a working knowledge of structural steel engineering would be necessary to get successful results. After looking into this phase of the situation pretty thoroughly, I am convinced that such is not the case, or the following reasons:

1. Very little machinery which is built today was designed by a man who had a working knowledge of structural cast iron design.
2. Castings are designed by cut and try methods. The engineer guesses about what the thickness and weight should be and adds on 200 to 300 percent for factor of ignorance and lets it go at that. If the casting is too light he makes the next one heavier.
3. If the casting gives satisfactory service, we know that if we design the steel piece for the same stiffness, we will be safe.

In a machinery base, stiffness is the determining factor in most cases. Therefore, if we reproduce a casting in welded steel, we may expect the welded steel base to weigh about one-half as much as the casting. If the base is properly designed, the holding down bolts merely keep the base from moving in a horizontal plane on the foundation. There is no force tending to lift the base, and the weight of the machinery mounted on it tends to hold it down. The force tending to make the base move in a horizontal plane on the foundation comes entirely from vibration of the machinery mounted on the base. This force is so slight that very light lugs attached to the side members by welding may be used. The practice of making the nuts on the holding down bolts bear on the main beam section of the side members came about largely, due to the fact that in the design of cast iron bases, light lugs cannot be used due to the inherent weakness of cast iron. As a result of this practice, followed in cast iron, the whole machine base is designed heavy enough so that with the biggest wrench which can be applied to the nuts on the foundation bolts, and the biggest man pulling the wrench, the base cannot be distorted. The main purpose of the base is frequently lost sight of in an attempt to prevent distortion by the holding down bolts.

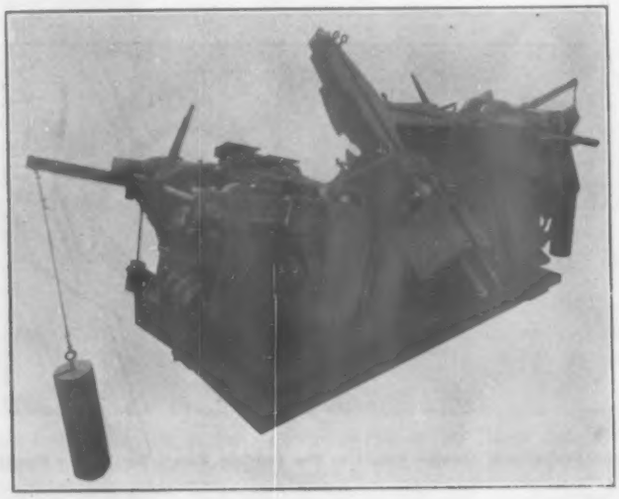
No intelligent welding man who will use his common sense need have any hesitancy about redesigning a machinery base for welded steel. A very casual study of how cast iron bases are designed will convince anyone that there is room for a lot of improvement.

Butt Welding Long Seams

Application of Resistance Butt Welding to Long Seams Makes Possible Rapid Production of Welded Steel Auto Bodies

MENTION has often been made of a very interesting feature of electrical resistance welding which is concerned with the manufacture of the welding equipment itself. The principles governing the operation of resistance welding are so simple and so uniform that very little is left to the ingenuity of the operator. The other common forms of welding are so flexible in their operation that individual operators often work out clever solutions of welding problems after they have become accustomed to the use of the apparatus. In resistance welding the solution of the problem usually has to be built into the machine, so it is only in rare cases that the manufacturer can expect improvements in operation to be developed after the machine is put to work.

The two types of work described below employ the same fundamental welding principles, but because the work itself is of a different nature in each case there is a considerable difference in the machinery which was finally developed to handle the work. In each case the finished product called for a seam weld. Seam welding has been accomplished successfully with the resistance process using various types of roller arrangements, but none of these types of seam welders appeared to be adaptable to the



Butt Welder for Auto Bodies.

fabrication of the products to be described, and the solution was found in making a butt weld. That is why the two pieces of equipment illustrated here are both classed as butt welders, though one is used on long seams.

The difference in the appearance of the machines is accounted for by the difference in the work to be done. One of them makes very long seams in thin sheet metal, and the other makes a comparatively short seam in a much thicker stock.

The automobile body welder was designed and built for assembling back panels in closed car bodies. One of the large automobile factories which makes its own bodies has had one of these machines in operation for two years, and another one for a shorter period. Two other machines of this type have been established in the plant of a company which specializes in the manufactore of bodies. Since they have been in service long enough to demonstrate the practicability of handling work in this manner, the Federal Machine and Welder Company of Warren, Ohio, who build apparatus, consider the process can be classed as a commercial success.

To give a general idea of how bodies are welded in this machine, the back body panel is mounted between two welding machines or proper supports, which are not shown in the photograph, and the side panels extend vertically from the top of the welder. These supporting devices are not shown in the photograph because the equipment is so large and bulky that it would cover up most of the welding machine itself so that the photograph would not give any idea of the construction. The supporting devices, of course, vary with the design of the entire body.

Reference was made above to the fact that there are two welding machines shown. As a matter of fact, this outfit consists of two separate butt welders mounted on a single base. Each machine has a two hundred K. W. transformer installed, or a total of four hundred K.W. for the two units. They do not operate simultaneously. The clamping equipment is controlled by air cylinders designed to operate from an air pressure line, giving eighty pounds pressure per square inch.

The photograph shown illustrates the outfit for welding a type of closed car body which has a fifty-six-inch seam following the curve, that is the full height from the body base line to the roof line, including a six-inch overlap which extends to the roof. The

Butt Welder for Steel Rims.

welding operation consumes approximately five seconds time, and the production is estimated at forty complete bodies per hour.

The machine shown in the second illustration was made for butt welding rims of steel wheels. In this case the weld to be made is a five-inch weld in ⅛-inch metal. The change from one type of work to another with the gas or arc process would be only a matter of changing the size of the tip of the torch, or of the electrode, making corresponding adjustments of gas pressure of current. A resistance welder, however, is made to keep on working on a particular class of work, and so it is not surprising that the change from one job to another brings about a considerable change in the difference of the machine. This may be equally true when the character of the weld itself is not changed, but only the shape of the piece, because as a rule the jig or holding device is an integral part of the resistance welder.

The machine illustrated is equipped with a motor-driven mechanism for applying the final push-up which eliminates most of the manual labor necessary in welding rims. All the welder has to do is to place the rims in the welding jaws of the machine, step down on a foot lever which operates the air clamps, then by pressing down another foot lever he sets the machine into operation. The current is turned on for a pre-determined period, the automatic push-up device goes through its complete cycle of operation and at the completion of the weld the current is automatically turned off, and additional pressure on the foot lever

automatically releases the air clamps and the operator takes the rim out of the machine.

In practice a machine of this type can be made to operate at very high efficiency. Seven of them are operating in one plant devoted to the manufacture of wheels, and the superintendent reports that an operator can turn out six hundred welded rims per hour. It is not unusual for this plant to operate twenty-four hours a day, and four machines have been in operation on this scale for two years without giving cause for complaint.

There is quite a range of possibility for resistance welding between a fifty-six inch seam and a five-inch seam, and it is reasonable to suppose having taken care of the extremes, the process can be applied to problems of assembly which would fall inside this range. It is not a question whether a particular product has been successfully welded before, so much as whether it is possible for the engineers who are developing resistance welding equipment to devise means for handling new work. Such problems are largely of a mechanical nature, but where the production is large enough, the investment in special machinery is usually justified.

WATER WHEEL CASING REPAIRED BY ELECTRIC ARC WELDING AT A SAVING OF $800

An electric arc welding operation was recently performed at the paper plant of the Parker Young Company of Lincoln, New Hampshire, that saved that company approximately $800 and completed the job in eleven weeks less time than otherwise possible.

A water wheel casing was badly in need of repair. The water wheel bearing had become worn and the wheel had moved over so that a section of the casing had been worn away. The worn section was about 10 in. wide and ¾ in. to 1 in. deep around the entire periphery of the casing. In some spots the casing was worn away entirely and in others the thickness of the parent metal was only 1/32 in. Some holes up to one foot long had been covered by a patch on the outside, and presented a real job for repairs.

Water Wheel Casing

With the aid of a Westinghouse 200 ampere, three phase, 25 cycle, 550 volt, portable arc welding set this repair job was welded. The very thin section and the part that was entirely worn away were first spanned by circular hoops of steel rods. The first rod, ⅝ in. in diameter was welded to the neck of the casting. Another ⅝ in. rod was welded to this one, and a ¾ in. rod welded to the second rod. A space was left between this third rod and the next one, large enough to insert a ⅝ in. rod. A ½ in. rod was then welded to the cast iron casting itself and the ⅝ in. rod was then inserted in the place left vacant for it, and welded to the rod on each side of it, thus bridging over the weakest part of the casting. The rest of the worn section was then filled in and the surface of the casing ground to a smooth finish by means of a portable grinder.

The striking feature of this job is that it was completed at a cost of approximately $200 and in seven days time, whereas a new casting would have cost about $1000, with a delivery of at least three months.

REPAIR TRUCK CARRIES COMPLETE CUTTING AND WELDING OUTFIT

The California Highway Commission operates a one-ton service truck, specially equipped to take care of general field repairs. The truck carries a complete cutting and welding outfit as shown at the right in the accompanying photo. It also carries babbiting outfit, spare parts, emergency repair materials together with a full set of hand tools, even to machine screw taps and dies. A hinged platform at the rear

The Peripatetic Welder Can Use the Cutting Torch for a Can Opener if Necessary.

when lowered to a horizontal position becomes a work bench resting on two steel supports and the hinges. When raised to a vertical position, the steel arms fold into the under side and the bench becomes the rear door.

The truck carries two cots which are hinged upon the sides of the bed for use of the mechanics. They effect a material saving in time and also eliminate hotel bills. This outfit saves time and expense in field repairs, as it practically brings the shop to the job. The crew usually consists of two first class mechanics.

ROEBLING BOOK ON THE MANUFACTURE OF ROPE WIRE

A twenty page booklet which has been prepared by the John A. Roebling's Sons Co., Trenton, N. J., makes a comparison of acid open hearth steel and basic open hearth steel as used in the manufacture of rope wire. The booklet is prepared by Mr. H. C. Boynton, a metallurgist. Its purpose is to describe in simple language the difference between steels made by the acid and basic processes and it fully meets the demand for a popular treatise on this subject.

Procedure Control Illustrated

Paper Read Before I. A. A. Convention Shows How Selection of Material Solved Problem of Welding Steel Furniture

DURING the meeting of the International Acetylene Association which was held in Chicago in November, Mr. S. W. Miller, research engineer in the Carbon & Carbide Research Laboratories, read a paper concerning the most important thing in welding. This "most important thing" turned out to be "procedure control," a phrase which has gained favor in the welding industry because it signifies scientific and systematic supervision of all welding operations. It was probably unintentional that one of the other papers on the program of the convention should serve as a beautiful illustration of the application of procedure control to a welding problem. The paper referred to was presented by Mr. M. F. Bayer of the Simmons Company, Kenosha, Wisc., and told the story of production welding on steel furniture. It developed in the reading of this paper that satisfactory results were finally obtained as a result of adopting a special kind of filler material for the work, in other words, through the application of one of the factors of procedure control. Mr. Bayer's excellent story of this development follows:

WELDING STEEL FURNITURE

The Simmons Co. has been engaged in the manufacture of metal bedsteads for more than a quarter of a century.

It was not until recently that the Company conceived the idea to make a complete line of steel bedroom furniture such as can be used in any home or hotel, or other institutions.

Before the Company started the manufacture of metal furniture some three years ago, it was very necessary to give this proposition a great deal of serious thought from various angles.

here are hundreds even yet who through shapes of malleable

Wood furniture, as we all know, has been the predominating furniture, throughout the civilized world, and it was very necessary before going into the production of steel furniture, to be able to not only bring out a product that would prove superior to wood, but also a product that would be commensurate with the tastes embodied in wood furniture, yet superior in finish and wearing qualities over any known wood furniture.

It has been, therefore, the duty of the Experimental Department to do a lot of development work in this line, and upon analyzing the design and nature of the furniture to be produced in steel, is summed up something like this:

The first cnsideration was the method used in fastening the different parts together. As we all know, wood furniture is either fastened by means of wood screws, nails or glue. We were aware that practically the same method could be applied to steel. Instead of the wood screw we could have substituted the machine screw; instead of the nail we could have used a rivet; but when it came to the glue we realized that the only superior method that could supplant the glue would be welding.

The next question arose was what method of welding should he applied, as we all know that there are various methods of welding employed at this stage. So it was up to the Experimental Department to find which of the methods was superior on this class of work. After a great deal of extensive experimenting by all the known processes, such as electric-spot welding, electric butt welding and last but not least, the Oxy-acetylene welding, I am happy to state that the latter method was adopted.

The next problem, however, that confronted our situation was the proper filler rod to be employed. This was very important from various angles. The furniture as manufactured from wood created a competition that had to be dealt with very thoughtfully. We knew from experience that steel could be welded with a steel filler rod, but we have found from our various experiments, that welding with a steel filler rod had a tendency to retard rapid production, and it was therefore very necessary to find a filler rod that would bring about very rapid and economical production, so as to whip in line this new idea with the old-fashioned idea of production of furniture from wood. After trying various alloys for a filler rod, we have found, with the co-operation of the Aanaconda Copper Co., a self-fluxing bronze phosphorus filler rod which makes it possible at this time to not only compete with wood furniture from a manufacturing standpoint, but also instill to the various joints superior strength and indestructible qualities never known in the production of furniture before made as in wood. To make this possible a great deal of credit must be given to the Oxy-acetylene process in general, for without this process it would not have been economically or commercially possible to produce steel furniture. That is one of the main reasons, gentlemen, why steel furniture today as being produced by my company is a success.

By using the self-fluxing filler rod, we have overcome one of the greatest obstacles in connection with economical production of steel furniture, such as warping of the metal and oxidization of the welded member. Oxidization, as we all know, is destructive to any weld. By means of this rod we have been able to produce a joint of very high tensile strength, because brazing by the old-fashioned method where a filler rod is used in connection with flux a great many objections were found, as a flux would leave a residue of a molten substance which is very hard to remove from the surface after the brazing has been completed. The removal of this flux is a tedious and costly operation and if not removed, this flux deposit in the course of time would soften and peel off from the metal to which it had adhered, resulting in the cracking and final destruction of the finish which had been applied to the article on which brazing had been done. This bronze rod of which I speak as self-fluxing has eliminated this objection entirely.

By producing steel furniture in this manner, we have been able to demonstrate the superiority of this furniture over wood to the extent that I believe in time to come steel will predominate in the art of furniture making due to the superior construction and lasting qualities as outlined above.

Wood furniture, as we all know, is subject to the various climatic conditions. It will either warp, shrink or otherwise be destructed. This is not possible, however with steel, and from the standpoint of finish, metal furniture can be and is baked at a very high temperature, giving a very tough and hard finish that is impervious to any alkalies or alcohol that may have been accidentally spilled, which makes this metal furniture superior to any furniture that can possibly be made from wood.

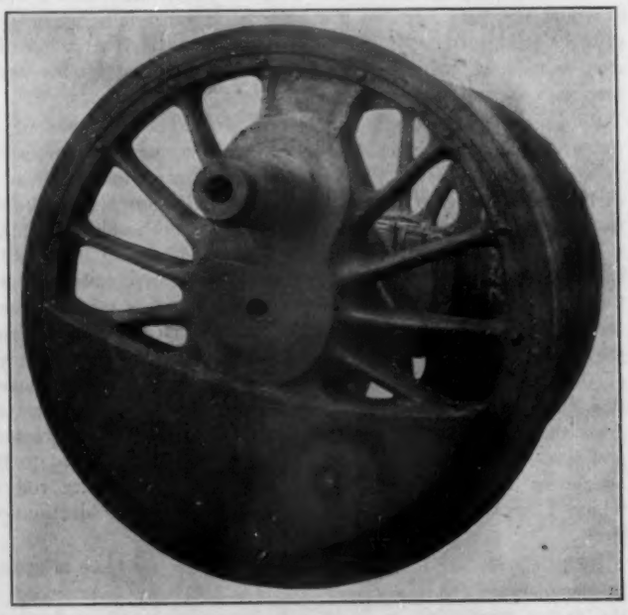
The Simmons Co. is also a very large user of special and automatic machinery which is built in their own plant. Many of these machines are very intricate and costly to build. Before the advent of Oxy-acetylene welding, these machines were built, as we now find, unnecessarily heavy due to the fear of breakage, but since the use of the Oxy-acetylene torch has become so popular in many cases, we have supplanted the old cumbersome machines with a machine lighter in construction and which makes it possible to run these machines smoother and faster than the old type of heavy machines. This also enables us to increase our production and destroys the everlasting fear of cumbersome and expensive patch work, which adds to the high cost of maintenance. Here again credit must be given to the Oxy-acetylene process which enables us to restore and put back into the service these machines in a fraction of the time heretofore required before the advent of this process.

In closing, I wish to say that the Simmons Co. is so well pleased with the results obtained from the Oxy-acetylene process, that it has installed its own complete Oxygen and Acetylene Generating plant and an extensive pipe line throughout the entire plant for the purpose of carrying the gases to the welder for the purpose of manufacturing and maintenance work in and about the plant, that it would now seem almost impossible to carry on without its best friend, the "Oxy-acetylene Torch," is the least that can be said.

I have with me several slides and photographs which will illustrate the various stages of production of this furniture, and if you are interested and the stereopticon machine is available, I will be very glad to illustrate the different views that were taken in our plant in actual production.

TWO NEW USES FOR WELDING IN THE LOCOMOTIVE REPAIR SHOP

The accompanying photographs show two new applications of electric arc welding in the repair of locomotives. In one instance a locomotive driving wheel has been repaired and, in the other, a worn stoker conveyor screw which is to be reinforced.



Welding Repair on Driving Wheel.

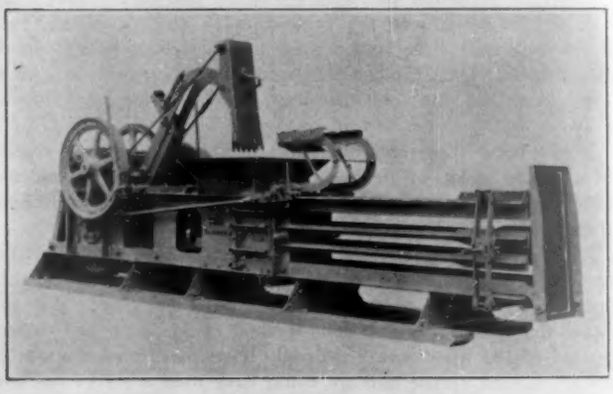
The driving wheels shown are six feet in diameter and are often broken in the spokes where the wrist pin takes the driving thrust. The cracked spokes are cut through and beveled with the cutting torch and ground off to remove all scale. The spokes are welded using a $\frac{1}{8}$-inch electrode and 160 to 170 amperes. No preheating nor any special precautions are necessary to take care of expansion or contraction. In the space between the spokes is placed a steel reinforcing plate, 1½ inches thick and beveled at the edges to make easy welding. This is welded in the space working from both sides. The plate distributes the strain over a larger area and no driving wheel repaired by this method has ever broken in service. To repair two spokes and weld in the plate is a four-hour job for two men.

Welded Conveyor Screw.

Conveyor screws used in automatic stokers are made of cast steel. In this work there is a natural grinding and abrasive action which wears the blades or flights of the screws. A screw often wears down in six months, or after approximately 200,000 miles of service. Usually the full length of the screw is not worn, but one end being affected, and about $12 spent for welding will reclaim it. The method used is to have a spiral reinforcing ring made up of steel strips by a blacksmith. This ring is tacked in place on the screw and then welded along the entire length of both edges, using $\frac{1}{8}$-inch diameter welding rod and 160 to 170 amperes. This is a 12-hour job for one welder.

NEW PAPER BALER MADE OF WELDED STEEL

The new type of Baling Press for baling waste paper, scrap from textile mills, etc., shown in the accompanying illustration, is made by The Ohio Cultivator Company of Bellevue, Ohio. Riveting of the structural members has been entirely replaced by electric arc welding, Lincoln equipment being used on the work. It is claimed that one of the principal difficulties with baling machinery has been eliminated by this type of construction. Using riveted construction, during the use and abuse of the equipment, the rivets were likely to work loose. On the other hand, it is stated that in the welded design, the welded joints have been made so much stronger than the strength members that it would be necessary to wreck the whole machine before the joints would work loose or fail. To make the various parts of the machine replaceable, some bolted joints are used so that the machine can be taken apart.



Welded Paper Baler.

The Ohio Cultivator Company has developed a wide field of usefulness for arc welding in the manufacture of agricultural machinery and baling presses. A number of pieces formerly made by use of gray iron castings are now made of pieces of steel welded together. The advantage claimed is that the equipment can be built in welded steel with less weight and that it will not break in service. Careful inspection methods are followed to insure each weld made against defective workmanship in spite of the fact that the weld is designed for more than twice the factor of safety usually allowed in riveted steel construction.

Welding in Homes and Theatres

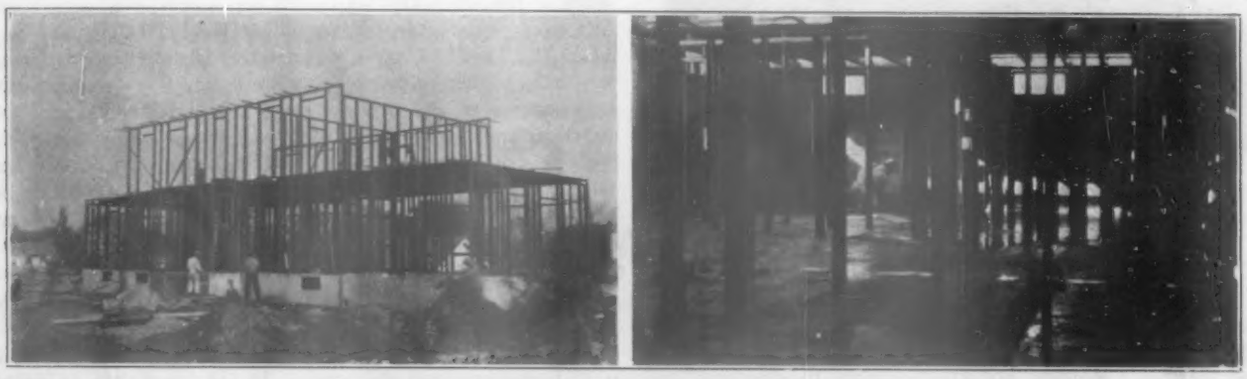
Some Interesting Examples of Welded Steel Structures Which Show How Far the Process Has Grown Beyond the Experimental Stage

By C. J. Holslag*

STRUCTURAL ARC WELDING ACCEPTED

WHILE a lot of publicity is being devoted to structural arc welding, and experimental buildings, roof trusses, etc., are being built and tested. Buildings both useful and experimental have been built by the various welding apparatus companies; this article, however, deals primarily with arc welding structural work that is in service, accomplished, and accepted by municipal and state authorities.

At the risk of being considered round about, I want to give credit to the roof truss arc welded by the Electric Welding Company of America which obtained the approval of the New York City authorities, and the buildings put up by the General Electric Company, Westinghouse, Lincoln and American Bridge by this process. These buildings were made with standard structural shapes not all of which fit best into the scheme of electric arc welding.



Welded Residence in Process of Erection.

It is quite a shock to some steel fabricators to learn that webs of angles, channels and I beams are not always necessary and that the strength can best be met by other means. For instance, there is a structure practically made of wire welded together, put out by the Concrete Steel Company of Akron, Ohio. The bottom and top cords as well as the struts are ingeniously formed from bent wire and arc welded together where they meet. At each end they are all joined by the same process to a standard structural shape.

A completely welded house at 766 Carrol Place, Teaneck, N. J., was made jointly by the Weldcrete Company of that city and Electric Arc Cutting & Welding Company of Newark, N. J. The house is made very similar to a wood frame house only steel is used for the frame. It was built in sections flat on the ground, raised into place and welded together. Everything is welded in this house even to the toothbrush holder in the bathroom.

Another building embodying only welded construction is being put up at 152-156 Jelliff Avenue at the plant of the Electric Arc Cutting & Welding Company in which the roof is made with standard joists from the Concrete Steel Company, the columns are standard Lally columns which for years have practically been accepted by all authorities and are made entirely by welding, the special frame at cap and base being nicely adapted to this process. The roof, sides and windows are being put in according to the Weldcrete process. In this building also no joint is made except by the welding process.

Another beautiful adaptation of arc welding is the putting on and attaching of roof purlins to the rafters where a fireproof slab roof is used, such as that marketed by the U. S. Gypsum Company or the Porete Mfg. Company. Here the standard T Bars formerly drilled, bolted or tapped in place by hand up on the roof are replaced by simply cutting and fitting the pieces and tacking them in place by arc welding, one welder being able to attach as much steel as a gang of iron workers can put up. When you realize that on gable roofs practically every piece has to be fitted in place on the job, the advantages of welding are apparent. Buildings in this vicinity that have been thus welded are as follows:

Markus L. Ward Home, 70 ft. roofing, Maplewood N. J.
Bound Brook Theatre, Bound Brook, N. J.
New Maplewood Theatre, Maplewood, N. J.
Fordham Road & Jerome Ave. Theatre, N. Y. C.
Theatre Mt. Morris Ave. and 186th Street, N. Y. C.
Theatre on 86th Street and Lexington Ave., N. Y. C.
Mont Eden Ave. and 176th Street Theatre, N. Y. C.
Bread Street Theatre, Elizabeth, N .J.

The apparatus with which this work is done is incidental and any machine can be used. In the Weldcrete construction A. C. was used, four machines being run from one transformer, and in the Porete installation only Dualarc generators, made by our company were used, whereas in the U. S. Gypsum installations generators of various makes including our own were used. Some were motor driven, others gas engine driven, etc. Where there is electric power available or the building is to contain electric power, as is generally the case, it pays to have a separate meter put in for the welding.

There have been other completely welded buildings in other cities, especially Cleveland and Detroit, all of which I hope bears out the title to this article, namely, that structural arc welding is accepted. To use structural welding to advantage one does not have to go to the extent of putting up a building. There are thousands of uses in the shop, piecing out and joining members together to fit special needs, iron work, ornamental, special, etc.

In other cities changing of buildings has been done by the

*Electric Arc Cutting & Welding Co., Newark, N. J.

electric arc process. The Foundation Company have just finished a very imposing work of this kind having completely changed over the interior steel structure boiler framing, etc., of the Prudential Building, corner Bank and Broad Streets. Here arc cutting and welding was used extensively; cutting to remove the parts and welding in fitting and replacing. Speaking of this cutting, the cutting of all the steel that was done in the field on the Weldcrete-Teaneck job was performed with the perforated cutting electrode and our a. c. machine.

Electric Arc Welding is more perfectly adapted to structural work in metal than perhaps to any other single industry. There is no imaginable form of steel structure, large or small, that could not advantageously be put together by welding. Not only does welding offer the structural industry greater facility, efficiency and durability in the results it produces, but it accomplishes these results at an appreciably lower cost. And this applies not only to all steel construction, but to any

Where Builders Are Finding Good Use for Welding.

construction in which metal is joined where the joint is required to be strong, tight and lasting.

The peculiar qualities of the electric arc which render the process so well suited to all forms of structural work are brought out to the highest degree of usefulness in building construction. The most important quality to structural designers and contractors is that of rigidity, for if a joint may be had which possesses rigidity and strength, the problem of designing and proportioning the entire structure may be solved with confidence in the result. It is this confidence that our engineers have worked to make the result of our process, and with what success this has been accomplished, our records of proficiency will show.

Next in importance comes the practicability of the arc process. A single machine and operator forms a complete producing unit which can work independently. Contrast this with riveting in construction work where a gang of men is necessary for punching, fitting, aligning, heating and riveting. If a single one of these steps is poorly or inaccurately done, the entire result suffers. In welding, the operator, the electrode and the machine alone determine the results. When the machine is in good shape and proportioned to the job at hand, the rest depends upon the operator, but a good machine helps a good operator and it is a better policy to depend upon one good machine and welder than to multiply the chances for inaccuracy and incompetence.

A subject more fully appreciated perhaps is the matter of tightness of welding. Since many tanks are practically structural in design, the subject deserves a place here. Riveted joints that are required to be water, air or gas tight must be carefully filled and caulked; there is no other way out of it. An arc welded joint is in its very nature tight without caulking. There is no warping or twisting in such a joint. For these reasons, welding is often used to close up already riveted seams when other methods to make a tight joint have failed due to the continuous loosening of the rivets. The most logical method, then, would seem to be the construction of the joint by welding in the first place.

Another tremendous advantage of the electric arc in construction work is its great adaptability in creating on the spot structural shapes to meet any particular need. For this reason builders find the arc process capable of the most extended service in such a variety of applications as metal window framing, corner-angle work, metal stairways, newel posts and hand rails, doors and door framing, stiffening members, chutes, hoppers, balconies, straps for holding piping and conduits, etc. We are able to suggest but a fraction of the number of uses to which this process can be put.

Workers in iron and steel of all types of products have found the arc process universally adapted to their needs. Ornamental iron work of every nature is done more efficiently and more neatly by means of electric welded joints. The arc in this work makes possible the smooth realization of the design with no unsightly rivets or bolts. And besides being pleasing to the eye the joint is the strongest and most durable one that can be made.

But, as electric welding is relatively new in the structural field, the designer will have to cast aside many of his prejudices (caused, of course, by the limitations of other methods) and learn to know welding. So he will find that his work is simplified and his results less a matter of uncertainty. We have prepared an "Arc Welding Handbook" which should be in the hands of every engineer, construction designer and user who wishes to prove the advantages of arc welding. Our own engineers are always ready to supplement this with practical advice on particular problems. We know what welding can do, and we know that we can show how a construction problem can be solved with a gain in efficiency and durability and a lessening of cost and labor. As a matter of fact, the electric weld is not so much a joint as a process for uniting metals into one mass—melting them together. This is why separable link fastening, as riveting or bolting, will not compare with carefully designed welding.

The heat applied is so intensely localized that the fusion is instantaneous and the strains do not have time to extend over the piece. For this reason shapes like the truck body shown may be tacked together by partially welding in a jig to hold the pieces in alignment, after which the welding may be completed in any convenient manner.

Electric arc welding is applicable to construction already built by other methods. How it is used to tighten up on loose riveting has already been mentioned. An interesting experiment in this connection may be performed. A seam, riveted as tightly as possible, is then welded up firmly. After the welding has cooled it will be found that many of the rivets are loose. This demonstrates the intimate contact that would be made by welding, even if the process itself were not a melting together of the two masses. For this season the welding of straps, hangers, forgings, large or small or any sort of projection or support to a larger plate is 100% practical. This property of welding is of great importance in shipbuilding work.

FOLDER ON SAND BLAST EQUIPMENT

The C. H. Hollup Corporation, Chicago, have issued recently a small six page folder describing the Hollup sand blast equipment. This equipment is made for cleaning surfaces of metal in industrial plants, foundries, railroad shops, and etc. The Hollup sand blast is a compact outfit which is readily portable and convenient to use. The hopper which holds the sand is made entirely by welding.

Recollections of a Salesman

Experiences Which Show a Variety of Reasons Why Every Operator Should Be Completely Informed On All Subjects Pertaining to the Equipment He Uses

THERE is an old maxim, "A little knowledge is a dangerous thing," which applies very aptly to the oxyacetylene operator who knows a little something, and makes that little cover a "multitude of sins." This is particularly applicable to the person who, in the role of adviser or consultant, imparts suggestions to the manufacturer which are responsible for amplification of risk in operation or for defective products, or for increased manufacturing costs. That such occurrences are a reality hardly seems possible, and yet it is a fact that they are more frequent than is warranted, especially when we consider the efforts that have been made to develop and perfect the process.

Some time ago (only a matter of months) the representative of one of the smaller apparatus concerns called upon a manufacturer using their type of torch in conjunction with a competitor's regulators. He was asked for advice regarding the proper pressures to be used on certain sizes of tips. Sad to relate, this particular concern had no pressure or capacity chart to offer. The service man—if we may apply that term—replied that it was merely a matter of opinion, depending upon the size of flame required, and that for the largest tip, which at the time was being used, he suggested an acetylene pressure which, to the operator, appeared excessively high. When an objection was voiced, the operator was informed that this same tip was often used with an acetylene pressure of about 30 lbs. per sq. in. Needless to relate, the advice of the service man was never used, and the manufacturer finally obtained his own data by a few simple experiments which determined the pressure that would give the best and cheapest operating conditions.

At this same concern, on one particular process, two torches were operated from the same regulators by means of divided hose lines. Naturally, the flames were balanced as closely as possible at all times in order to synchronize the various stages of the work. In the experimental work and in the regular production schedule this same practice was adhered to, regardless of the unusual conditions under which the torches were used. That is, both torch heads were inserted through a protective device so that the deflected heat from the work was shot directly back at the tip and torch head. Naturally, these were affected by the heat, particularly the torch heating the preliminary stage of the work. Also, this same torch was located so that it could not possibly obtain the quantity of oxygen from the air necessary to complete the reactions which are the result of the combination of oxygen and acetylene. It required a great deal of effort and persuasion to permit the slight change necessary in the balancing of the flames to offset this condition, and yet the substitution of a slightly oxidizing flame for the one torch and a neutral flame for the second torch effected an economy in time of 15 to 20 percent on various sizes of work, while eliminating the objectional features mentioned before.

This one concern was unusually hampered in a large number of its products due to the same faulty advice. Numerous smaller items, that ordinarily might have been made directly from raw stock by simple machine operations, were fabricated by brazing at an enormously high cost, and the brazing methods themselves were of so ancient a vintage it was difficult to conceive of anyone using them with our present knowledge of methods and practice.

Only after very urgent persuasion following upon the most tactful presentation of facts were the officials induced to see light. The natural result was a financial saving that was amazing.

* * *

That there is gross ignorance regarding the various combustibles is undoubted and the blunders perpetrated as a result of this are sometimes such as to make the perpetrator appear ridiculous in the eyes of those who are in the know. It is not so very long ago when newspapers frequently reported acetylene tank explosions in shipyards with such frequency that it became rather alarming. And this was because the cutting operators were styled "acetylene burners" regardless of the very material fact that in many cases the combustible was not acetylene.

Naturally, such reports were read by the multitude and believed. Corrections by technical magazines, the "Welding Engineer" in particular, helped assuage this state of affairs, but the damage could hardly be repaired so easily.

Witness a news item appearing in a New York City daily as follows:

"GAS FROM TOY BALLOONS STINGS LITTLE GIRLS"

which goes on to say that a medical man had voiced an opinion that the contents of the balloons had been acetylene.

The fact that a professional man had made such a surmise makes good reading matter, but how many readers of this news item knew that acetylene does not sting, or that the "balloons would not soar heavenward when released" if filled with this gas ?

Oxy-acetylene operators frequently have peculiar experiences due to damaged hose. I remember reading of an operator who threw tank and hose off a bridge when the hose ignited. This action was probably unwarranted and was probably due to his excited state of mind.

Cutting in scrap-yards where automobile trucks frequently pass jeopardizes the apparatus. One operator could not understand why his torch failed to function upon his return to work after lunch and was very much peeved to find that the hose, which had been stretched across the road, had been mashed flat in a number of places, where the wheels of an exceedingly heavy truck had passed over it.

And at another time—this almost sounds like a fable—after a goat had partaken of a section or two of some seven-ply corrugated hose which lay conveniently on a lot where several steel tanks were being demolished, the operator heartily blessed the inhabitants of the neighborhood who allowed an animal with so unusual a gastronomic ability to rove wildly around.

But the best story of all centers around a young man who is now one of the executives of a large gas organization. At the time of this story he was learning to handle a cutting torch and was permitted to play with a small plate of mild steel. To make things easy he obtained an empty carbide can on which he sat while operating the torch. During actual cutting he was of necessity forced to lean forward, but at the completion of the cut he would lean back and rest after his arduous efforts. Strange to say, the torch would immediately be extinguished and no effort on his part could make it relight unless he applied it to the hot plate in front of him.

When he asked for advice, his difficulty was readily explained and he admitted it had taught him a simple lesson which he has most likely remembered to this day. Being rather heavy in weight and somewhat careless in his handling of the hose, he had managed to tip the can back on the hose each time he rested and so shut off the gas supply. Tipping forward released the gas again and the torch would relight.

In this same organization another student came in one day very excitedly to report an oxygen tank containing some 3,500 lbs. per sq. in. pressure. He had become so alarmed when he noted this that he had not even stopped to turn off the torch valve, but had fled to safer quarters and to announce his discovery. Actually, the pressure was the normal 1,800 lbs. per sq. in., but the high pressure gauge pointer had loosened and gave a false reading which would probably have alarmed anyone not sufficiently versed in the subject to see the reason for it.

In most cities fire underwriters are very stringent in their requirements for the safeguarding of garages and service stations using welding outfits. Their use is restricted to definite quarters with certain well defined precautions to eliminate the fire hazard which always accompanies the use of open flames in the presence of oil and gasoline. Still, welding is continually performed under the most dangerous conditions and with no thought to the safeguards which have been planned to protect, not merely the insurance companies which have assumed the risk, but also the individuals who are endangering themselves and the properties they themselves own or may be working on.

In one case the apparatus was carried on a light truck that was always shifted to dark corners when the inspector appeared and covered with anything handy so it was unrecognizable. As soon as the inspector was gone, out it would come to be used anywhere at all in the garage without any consideration at all for the dangers thus imposed.

At one time the inspector walked into the place while the welder was lying on his back under a car and did not even notice the apparatus standing conspicuously out on the floor nor the welder on his back, skillfully plying the flame and contentedly puffing his pipe. Possibly he did not want to notice it, but at any rate, "What fools some mortals be?"

NEW G. E. AUTOMATIC WELDER

A new design of automatic arc welder, which welds with great smoothness, speed and accuracy, has been introduced by the General Electric Company. With this equipment, the operator needs but to push a button to start the sequence of operations which produce the weld without any further effort or skill on his part.

The new welder starts the arc by first touching the electrode to the work and then withdrawing it, thereafter maintaining a constant arc length by feeding the electrode wire to the weld at the exact rate of speed necessary to replace the electrode fused into the weld. It is claimed that the new equipment will perform these operations more rapidly and with a greater degree of accuracy than is possible by the most expert hand operators.

The automatic welding head incorporates the necessary mechanism for feeding the electrode to the arc, and consists essentially of a pair of feed rollers geared to a constant speed motor through a magnetic clutch. The gearing and feed mechanism are contained in one housing to which the motor is bolted.

The feed rollers feed the welding wire through the nozzle to the arc. The distance and pressure between these rollers is readily adjustable. Each welding head is equipped with a set of nozzles for 3/32-inch, 1/8-inch, 5/32-inch, 3/16-inch and 1/4-inch wire.

The speed of wire feed may be adjusted by means of a selective gear changer which permits the gear ratio to be altered at will to adapt the speed of the feed rollers to the size of wire and the welding current used. Three gear speed changes can be made by moving the gear shift pin which extends from the rear of the gear housing. An additional finer adjustment can be made by means of a rheostat in the field of the motor.

Provision is made for pointing the electrode backward or forward in the line of weld, and also for moving it sideways. The pointing of the electrode is obtained by rotating the head on its horizontal shaft, and the lateral movement by means of the handwheel on the front of the head.

The control equipment consists of a control panel, a meter panel and a push-button station. The control panel mounts the main line contactor for the welding circuit and two smaller contactors for interlocking the travel motor with the arc. By means of auxiliary contacts, the line contactor controls the starting and stopping of the feed motor. The magnetic clutch is operated forward or backward by a voltage relay, the coil of which is connected across the arc. Thus the electrode is fed to or from the work automatically, adjusting itself to any irregularities in the surface of the work. One rheostat controls the speed of the feed motor and the other controls the voltage setting of the arc.

The new automatic arc welder will be sold either separately (where the user constructs his own clamps) or as part of a complete welding equipment including the necessary clamps and framework for holding the work. It will find its principal application in the construction of such standard products as pipe, tanks, boilers, cans, automobile axle housings, etc., where the welding operation is constantly repeated as part of a regular production schedule.

ANNUAL MEETING OF THE COMPRESSED GAS MANUFACTURERS' ASSOCIATION

The Compressed Gas Manufacturers' Association will hold the Fourteenth Annual Meeting and Dinner at the Hotel Commodore, New York, January 24th, 1927. The business meeting will be brief and is to be preceded by technical sessions starting in the morning, luncheon being served at noon.

The Association has been doing important work on the testing of gas cylinders and the results of original investigations on the subject are to be considered in papers to be presented and discussed. The compressed gas industry is a rapidly growing one, new application of gases are being constantly developed; and a review of the compressed gas industry as a whole with consideration of the interesting and important developments which may be expected will be a stimulating feature of the meeting.

A satisfactory supply of oxygen and acetylene and other fuel gases is essential to the development of the welding industry. Efficient and safe gas transportation containers are important factors in the supply of welding gases. Stimulation of the production of gases by the development of new applications will improve the supply of the gases for use in welding. The producers of welding gases and equipment are actively interested in the Association and the Annual Meeting and Dinner are attended by representatives of most of the leading producers of oxygen, acetylene, and welding equipment.

Arrangments for the Annual Dinner are in the hands of a committee consisting of Messrs. J. J. Crowe, Air Reduction Company, chairman; P. F. Lavedan, Liquid Carbonic Company; F. J. King, Linde Air Products Company; H. W. Bates, Pittsburgh Testing Laboratory; W. G. Swaney, Kerotest Company; and C. L. Gulick. An enjoyable and colorful banquet is assured.

DEMONSTRATION OF STELLITING AT A. W. S. MEETING

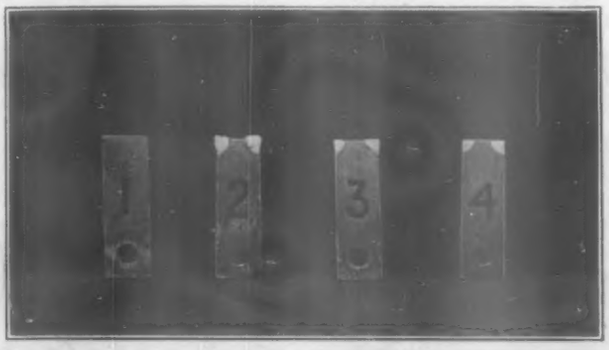
That a very wide application and therefore a very bright future exists for Stelliting was clearly shown at the October meeting of the New York section of the American Welding Society, held October 19th, when Mr. A. V. Harris, of the Haynes Stellite Company, delivered an address on "Stelliting—A New Welding Application." Large attendance showed both that Stelliting is of vital interest and that the local section is experiencing a healthy growth.

The characteristics of Stellite, its composition and correct methods of application were clearly set forth. An actual demonstration of Stelliting, with the oxy-aceylene blow-pipe, was given, several metal parts being Stellited.

The remarkable resistance of Stellite to heat, abrasion and corrosion is the reason for wide use of Stelliting in various industries and for its increasing application, it was shown.

A digest of Mr. Harris's remarks follows:

All grades of carbon and alloy steel can be Stellited, also most grades of cast iron. Principal uses of Stellite up to the present time have been on tool bits, milling cutters, gages, and various other products for use in large machine shops. It is not possible to Stellite bronze or brass but a fairly good bond is possible on copper when necessity arises. While it is possible to weld Stellite with



1. New Steel Hammer.
2. Stellited Hammer Before Grinding.
3. Ground Stellited Hammer.
4. Stellited Hammer After 92 Hours of Use. (Steel Lasts 14 Hours.)

both the electric carbon or metallic arc, and oxy-acetylene blow-pipe, the use of the oxy-acetylene method is said to produce cleaner, less porous and unalloyed welds.

Stellite is in no sense a steel but an alloyed metal composed of cobalt, chromium and tungsten, with iron present only as an impurity. All Stellite is cast into special composition moulds, and after casting the only way it can be reduced is by grinding, as it cannot be machined or filed due to its inherent hardness. This hardness is inherent, Stellite requiring no tempering; it can be brought up to a point very closely approaching its melting point and still retain its toughness and hardness. Subsequent cooling does not affect it.

Most remarkable is the fact that Stellite can be melted under the acetylene torch, fused to all grades of steel and practically all grades of cast iron, and still produce a surface which without any heat treatment retains its original properties.

For welding, so called, Stellite is made up in the form of the ordinary welding rod. Stelliting is not, however, truly welding nor yet brazing, but a cross between the two. Stelliting with the oxy-acetylene torch calls for but slightly different technique and blow-pipe flame from ordinary acetylene welding. Correct application can be made after very brief practice by any experienced welder.

Stelliting calls for a blow-pipe flame which contains a fairly large excess of acetylene to lower the flame heat and to exclude as much oxygen of the atmosphere as possible. The surface of the base metal on to which the Stellite is to be applied is brought up to a heat where the surface just begins to sweat and has an oily looking surface, the lightest penetration into the parent metal being most desirable as it eliminates the possibility of any alloying with the Stellite. At this point the Stellite is melted from the rod and allowed to flow on to the base metal with as little agitation as possible, the action of Stellite flowing on to the steel reminding one of solder flowing from an iron on to an already tinned surface.

The ability of Stellite to resist heat fits it for use in many manufacturing plants having production jobs in which they are forced to use a metal as highly resistant to heat as possible. Some applications are, use in hot-forming of sheet metal and the hot trimming of forgings, etc.

In the hot forming of sheet metal invariably a highly tempered die of carbon or alloyed steel is used, the temper being called upon to resist the heat as well as the abrasion. It does not take long until the heat of the forming operation has drawn the temper up to a point where the metal has begun to soften. When this occurs it is necessary to cool the die, re-machine or grind and temper again, this procedure being carried through until the die is worn down to a point where it is scrapped and it is then necessary to make new dies.

Stellite is very desirable on applications of this type as it will resist the heat without losing any of its hardness. A die of the common machine steel or carbon steel is made up in the usual manner and the surface which comes in contact with the heat and is subjected to abrasion is left approximately $\frac{3}{16}$ in. under size to allow for the building up with Stellite. After a die has been Stellited and ground to size it will stand up under the application which calls for the metal to resist heat and still retain its hardness. For instance, when, in the making of automobile crank shafts which are forged to a very close limit, a flash is left on the forging, it is necessary to trim this flash off while the metal is still in a hot condition.

Dies made of various steels and alloys have been employed in the making of these trimming dies and even though they do give

Correct Position for Stelliting.

as high as 2000 pieces before the die needs reworking, they are still very inefficient as compared to a Stellite die. It is only necessary to Stellite the portion on the trimming die which is subjected to heat; namely, the edge. Such a die will stand up and has stood up under as many as ten and twelve thousand operations before requiring reworking. It is then only necessary to return the die to the welder to be re-Stellited and then ground, no tempering being necessary. The only way a Stellited die ever approaches the scrap stage is when it becomes broken. Otherwise its life is indefinite. Trimming dies of this type will give from 4 to 6 times the number of pieces that the best steels can do.

Numerous other applications of Stelliting where resistance to heat is required, include forming dies for automobile spring clips, railroad anchors and other fairly heavy steel sections which require hot forming or shaping.

The ability of Stellite to resist abrasion is very pronounced, it outlasting as a rule any other metal three times and over. In the Portland cement industry metal parts of pulverizing, grinding,

crushing and conveying machinery are worn out in a very short time due to abrasion or wear. When Stellited these parts possess greatly increased life.

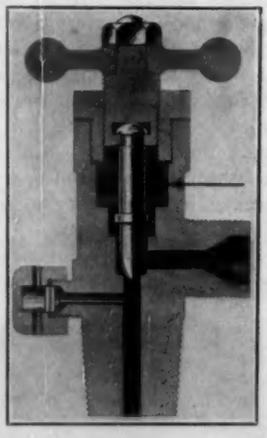
Stellite has many uses where both resistance to heat and abrasion are required, as in use on hot drawing and hot forming dies. The die is called upon to resist heat of the metal being formed and also of the abrasion of this metal being drawn for the die surface. Various plants throughout the country are now applying Stellite surfaced dies on these particular applications and as a general rule are getting three to five times the life formerly secured from the best tool steels obtainable.

"AND THEN AN EXTRA TWIST"

How a Salesman Convinced Shorty That Cylinder Valves Are Important Devices

At quitting time, Shorty, the foreman, hung his goggles on a hook in the locker. Then followed the brimless crown of an old felt hat, symbol of the welder's trade, and he grabbed a handful of soap.

"Learned something today, Slim. Funny we never figured it out before. So damn simple."



"Sure. Always is simple when you know how." Slim knew that when the foreman welder started off that way it would be worth while to listen.

"It's about oxygen cylinder valves. You know, I find that lately we're using less oxygen on the same jobs. I couldn't figure that out, so I asked the guy from the welding apparatus company who was around here last week."

"What did he say?"

"Well, he was smart as they make 'em. 'Shorty,' says he, 'it ain't altogether the gas you use, but the gas you lose that costs you money.'"

"What did that wise crack mean,—anything?"

"Maybe he knew, but he wouldn't tell me. Didn't want to knock anybody, I guess. But this morning the oxygen fellow was around and I sprung the use and lose thing on him.

"'Sure,' and he just laughed. Then he said, 'Shorty, you can answer that yourself. Tell me, did you ever have a valve stem leak on a cylinder of my oxygen?' I told him, no, I couldn't say as I had. Then he pulls out a picture from his pocket and gives it to me.

"'Well, you won't, Shorty, either,' he says, 'and here's why: Our particular kind of valves have what they call a back-seat arrangement—there.' Then he marked this arrow here on the picture. 'When the valve is wide open, the steam pulls up against that soft rubber collar and expands it inside the gland, and against the valve stem itself, all around. The oxygen, even if a little of it were to get by the rest of the valve, simply can't get out.'"

"Well, what do you think of that. That's sure a slick gadget."

"There's more. Then he said, 'If you open the valve all the way, the rubber will upset enough to prevent absolutely all leakage. But you can make sure, after the valve is opened as far as it can be turned easily with one hand, if you take a good strong grip with two hands and give it just about a quarter turn, just a little extra twist by hand. Simple, huh?'"

"You said it, Shorty. Guess we'll throw away those wrenches we used to use last year."

"Yep. See you tomorrow."

"S'long."

REMOVING RISERS IN THE STEEL FOUNDRY

On Friday evening, December 3rd, Mr. L. E. Everett, of the Nugent Steel Castings Company, Chicago, Illinois, read a paper entitled "Removing Risers in the Steel Foundry" before the Chicago Section of the American Welding Society. The value of the oxy-acetylene cutting torch to the steel foundry was emphasized by descriptions which were given in the paper of other methods of cutting risers which are in common use. The restrictions which govern the use of other methods as compared to the great flexibility of the oxy-acetylene torch were very marked. The speaker also pointed out that it was impossible to give any general set of cost figures because of the great variety of sizes and shapes and conditions which govern the cutting. It is also made clear that the cutting torch need not necessarily be the universal method of cutting steel risers because there are occasions when other methods can be used to better advantage and in such cases it is better to use them.

THERMIT USED TO BREAK UP ICE GORGE

What is stated to be the first use of thermit in this country to hasten the disintegration of an ice gorge occurred in connection with the great Allegheny River ice gorge at Franklin, Pa., in March of this year, according to a Weather Bureau official stationed at Pittsburgh, Pa., where all the river forecasting for this region is done. Thermit is a chemical compound which, on ignition, quickly reaches a very high temperature. When it is forced into ice the ice is blown apart by the steam produced. It increases in temperature 5,000 degrees F. in 10 seconds. Its action upon ice was recently discovered by Dr. H. T. Barnes, a Canadian scientist formerly on the staff of McGill University, Montreal.

The ice in the Allegheny River had started to pack during the first week in January near Franklin, and a stretch of 15 miles was eventually involved, constituting for 74 days a continual menace to industries and homes along the river. Property losses were very great. The damage at Oil City was estimated at $500,000, and at Franklin at $100,00. Much of this loss was sustained by the Pennsylvania R. R., whose tracks parallel the gorge throughout its length, and by oil companies through flooding of oil wells.

The inventor of thermit was called upon to undertake to relieve the situation by the use of explosives, both dynamite and thermit. A ton of the latter material was shipped to Oil City and used in almost daily charges at key locations in the ice.

HARMS ELECTRIC WELDER INTRODUCED AT POWER SHOW

A new system of electric arc welding was introduced for the first time to American users of welding, at the Fifth National Exposition of Power and Mechanical Engineering held at the Grand Central Palace, New York City, December 6th to 11th.

Harms System Welding Apparatus.

Personal demonstrations of the working of this system were given by Mr. J. F. K. Harms, the inventor, who introduced the machine from Europe and the Dutch East Indies, where it has enjoyed wide use.

The basic principle of the Harms system centers upon a constant voltage across the arc, so that smooth operation is easily obtainable. A feature emphasized by the makers is the ease with which skilful work can be obtained in a very short time by the operator.

The Harms arc welding apparatus is portable, compact, simply constructed and easily manipulated. Ordinary electrodes of any standard makes can be used.

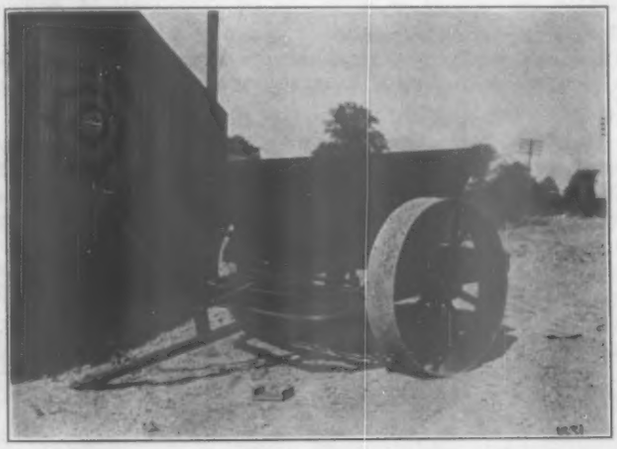
The system is recommended for use in factories, in repair shops, etc., where an ordinary direct current generator is available and for general welding of iron and steel and other metal. Originally, it was used for welding of boilers, pumps, condensers and other repair work aboard ships, where the power plants generally consist of steam-driven, direct-current generators.

The weight of the apparatus is 625 lbs., and the dimensions are 21x22x30 inches.

This apparatus will be marketed in the United States by Harms System Electric Welding Co., 342 Court Street, Brooklyn, N. Y., sole agents for U. S. A.

WELDED STEEL DUMP TRAILER

The accompanying illustration shows a new type of all purpose heavy duty dump trailer recently brought out by the Euclid Crane & Hoist Company, Euclid, Ohio. Designed for one man operation behind a tractor, the two wheel type of construction permits rapid movement over any kind of ground.



No Rivets on This Trailer to Come Loose. It's All Welded.

Electric welding is used in place of riveting on the frame to avoid possibility of loose rivets causing failure in operation. The dump itself is entirely welded to make it water tight so that the equipment may be used for transportation of grout.

The type of welded joints used throughout the construction of the equipment were developed through co-operation with the Research Department of the Lincoln Electric Company and by field service tests.

Economics due to the use of welding enable the manufacturer to market the equipment at a moderate price.

WESTINGHOUSE FIVE-STORY ARC-WELDED BUILDING TO BE INSPECTED

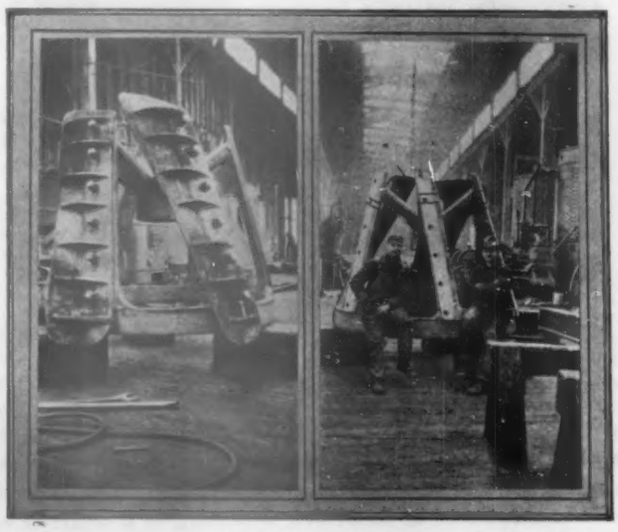
Rapid progress has been made in the erection of the five-story, arc-welded, steel building at Sharon, Pa., by the Westinghouse Electric and Manufacturing Company. A load test demonstrating the principles involved in the erection of this type of building has been arranged by the engineers of the Westinghouse Company. This load will be in place Wednesday and Thursday, December 15 and 16, and will be open to inspection to all architects, engineers and other interested parties on these two days.

A portion of the third floor of the building sufficiently large to obtain some complete observations will be loaded to twice the maximum load for which the floor is designed. It is estimated that 840,000 pounds distributed over an area of 1400 sq. ft. will be required for this test.

WELDING A SUCTION DREDGE CUTTER HEAD

By E. L. Clough

Six thousand nine hundred fifty pounds of casting recently fractured and gave me an opportunity to do this interesting piece of work. The casting is a suction dredge cutter head. It belongs to the Puget Sound Iron and Steel Works, Tacoma, Washington. The photos were taken after the fracture had been welded and machined, but the marks show where the break occurred.



Left—Blades Bolted to Welded Holders. Right—Blade Holders After Being Welded.

The picture at the left shows the blade holders with the blades bolted in place ready for service, the one on the right shows the welder and his helper and the blade holder after the repair had been made. The blade holders measure three by eight inches and are six in number. Each one was broken and had to be welded. The welding took one operator and two helpers about fourteen hours. The breaks were double V'd with a cutting torch by the operator. Then they were welded up with a 200 ampere General Electric equipment. Roebling mild steel rods were used for this work.

To be sure that this work was done properly and that it would hold up under actual working conditions I have waited six months before writing it up. It is giving perfect satisfaction and I wouldn't hesitate to tackle another job just like it.

ARC WELDED TROLLEY STATIONS

In the October issue of the General Electric Review, W. L. Warner, of the Industrial Engineering Department of the General Electric Company, describes the construction of arc welded shelters for street railways. One type is shown which was fabricated and erected by one welder and two erecters in about 9 hours' time. The material used consisted of 8 inch I-beams, 6 inch I-beams, 6 inch by 6 inch angles, 4 inch by 6 inch angles and 6 inch channels. The building is approximately 40 feet by 8 feet by 8 feet. This ought to be a good job for welding contractors who can keep track of location where such buildings would be desirable.

THE ARTISTIC SIDE OF ARC WELDING

The imperious looking eagle illustrated below was welded on a steel plate by Mr. J. W. Quinn, Welding Engineer for the Llewellyn Iron Works, Los Angeles, California. The picture was forwarded by Mr. A. H. Pier, whose company represents the Lincoln Electric Company in that city. Mr. Quinn is a practical operator possessing considerable skill, and his ability to obtain satisfactory welding results is best evidenced by the many large jobs he has personally completed

Artistic Arc Welding.

in that territory. Commenting on this particular piece of work, Mr. Pier says, "In our travels we many times find experienced operators who may make a good weld but the general appearance of their work is nothing to their credit or to the credit of the industry. We who are interested in extending the application of welding should encourage the operators not only to make a perfect weld but a presentable one. The first impression is usually the lasting one."

EXCEPTIONAL SERVICE SAVES CUSTOMER TIME AND MONEY

An example of exceptional service in furnishing arc welding machines occurred recently when a large steel fabricator who uses electric welding machines came to the Goodman Electric Machinery Co. of Newark, N. J., and asked to rent five welding machines.

The fabricator took the job on a penalty basis and had to complete the work by a certain date. There was not time enough to get new machines. Furthermore the power supply was direct current, and new machines would have to be made up on special order.

The Goodman Electric Machinery Company received instructions to furnish the 5 welders the first thing on Saturday morning. On the following Monday one machine was actually welding, and by Wednesday of that week all 5 machines were on the job.

This exceptional service was possible because the Goodman Electric Machinery Company make a specialty of buying, selling renting and repairing electric welding machinery, and always carry a large stock.

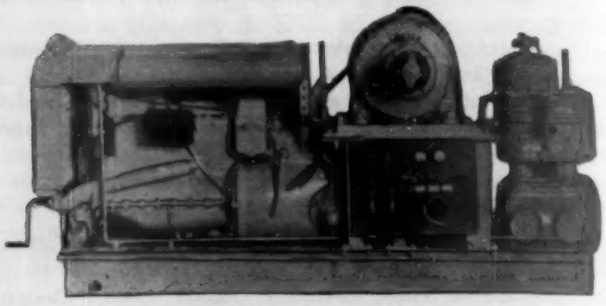
METALWELD COMBINATION ELECTRIC WELDER AND AIR COMPRESSOR

An efficient air compressor and arc welder or lighting generator driven by a gasoline engine and mounted on an all steel I beam framework, has been placed on the market by the Metalweld Service Corporation of 26th and Hunting Park avenue, Philadelphia, Pa.

The outfit consists of a Fordson Tractor engine of a heavy duty type, a Metalweld-Worthington Air Compressor and either a Lincoln, General Electric or Westinghouse Welding outfit.

The complete unit is compact, the compressor being driven by the power take-off shaft at the rear of the tractor, and can be operated at two speeds, one for heavy duty work and the other for light chipping or caulking.

The Fordson Tractor engine runs at a continuous speed of 1000 R.P.M. and is controlled by a fly-ball type governor. The



Combination Welder and Compressor.

engine develops 24 H.P. at this speed and can be started and operated independent of either the air compressor or welding unit.

For light work where small air requirements are needed, it is possible to run both the welding generator and air compressor at the same time.

The Worthington Compressor is a two cylinder, water cooled compressor with large water space having jackets 13 inches deep. The compressor is fitted with Laidlaw feather valves which can be replaced at little cost. The air compressor will deliver 110 cu. ft. of air per minute and is equipped with an automatic unloading and throttling device. In using the air compressor the pneumatic throttle control will throttle the engine down to idle speed when the compressor is unloading. This is a very important feature in that it is very economical and is a gas saver.

The electric welders are belt driven from the side power take-off and are controlled by an independent cloth. The belt is tightened by means of the slide rail of the welder. This combination outfit is not an experiment but has been used by the Metalweld Service Corporation in their own work in the past six years.

NEW ROEBLING WELDING WIRE CATALOG NOW READY

A new catalog of welding wire and electrodes has just been made ready for distribution by John A. Roebling's Sons Co., Trenton, N. J. This booklet gives complete description of the different Roebling wires and indications for their uses. It also includes data on the current and electrode sizes to use for different thicknesses of plate. Another bit of useful information is a page giving the approximate weight per pound of 100 pieces of wire of different sizes, the number of pieces per 100 pounds and the number of pieces per bundle of 50 pounds. A series of photographs shows the best method of putting new coils in reels for automatic arc welding so as to save heavy lifting and keep the wire in good condition for the welder. Another new development in the catalog is a line of welding cable.

LINCOLN PUBLISHES BOOK ON WELDING APPLICATIONS AND ADVANTAGES

"Arc Welding, The New Age in Iron and Steel" is the name of a new 160-page book recently published by the Lincoln Electric Company, Cleveland, Ohio. This book is devoted largely to the use of arc welding in general production manufacturing. No longer can arc welding be looked upon as a repairing or salvaging process. The arc welder is a production tool and this book makes it very evident that a knowledge of arc welding principles must be a part of the equipment of every designer and manufacturer working in iron and steel. The book contains more than two hundred illustrations, chiefly of products of representative manufacturers which have been manufactured by arc welding. In addition there are numerous diagrams and charts showing welding speeds and costs.

The book points out that there are two main fields for production welding. The first and perhaps the best known is the use of arc welding in place of riveting. It is demonstrated in this book that a welded joint can be 100% efficient, whereas the strength of a single riveted joint can never equal the strength of the members joined. Tank builders were among the first to recognize the greater economy of arc welding over riveting and today there is probably not a tank shop of any importance that does not use arc welding. Many other products formerly riveted but now arc welded are illustrated and described.

The second main field for arc welding is the substitution of arc welded steel for cast iron. This book makes the claim that 90% of the iron castings now used could be replaced by arc welded steel at a decided saving. There is a complete discussion of how to go about redesigning cast iron for manufacture in steel and the illustrations show clearly where this is being done commercially by representative manufacturers. The fundamental reason of the economy of arc welded steel over cast iron is that steel is six times as strong as cast iron in tension, 2½ times as stiff but costs only ⅓ as much. Examples of complicated machinery bases and other cast iron parts are shown reproduced in welded steel and in many instances cost figures are given.

The opening chapter of this treatise discusses the superiority of steel over cast iron from both the standpoints of strength and economy. The addenda to Chapter I is a technical discussion of this subject with diagrams and references to recognized authorities.

Probably the most impressive point about the book is the wealth of illustrations showing products which are now being manufactured by means of this new process. The procedure for redesigning machine parts is treated at length and there is complete data on the strength and cost of various types of welded construction.

One chapter is devoted to automatic arc welding and there are numerous photographs of products automatically welded.

TWENTY-FIFTH ANNIVERSARY OF THE BUREAU OF STANDARDS

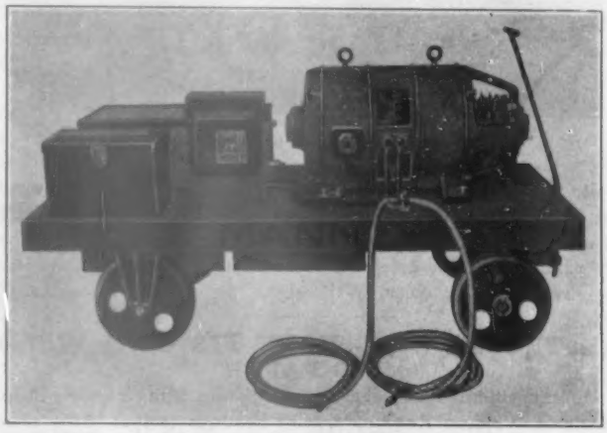
On March 3, 1901, during the last few minutes of the session, Congress passed a bill changing the name of the old Office of Standard Weights and Measures of the Treasury Department to the National Bureau of Standards, greatly enlarging its functions. The act provided for a staff of 14 persons, and also set aside a sum for the purchase of a suitable permanent site for the bureau.

The Bureau of Standards is now 25 years old. In this time it has grown from a minor bureau of the Government housed in temporary quarters, with a staff of only 14 employes, to be one of the foremost scientific and technical institutions in the world, with a staff of nearly 800 and with more than a dozen major buildings, each specially equipped for some particular class of work.

It is fitting that some notice should be taken of the completion of 25 years of scientific and technical research which has done so much for the country as a whole. Saturday, December 4, was set aside as "Visitors' Day," on which the bureau and its many friends celebrated its twenty-fifth birthday. On that day the bureau kept "open house," and many of its friends took this opportunity to inspect the laboratories and take a bird's-eye view of what has been called "The House of Wonder." A luncheon was served in the middle of the day, and in the evening a banquet was given by the staff at the New Willard Hotel.

THE MANN MASTER ARC WELDER

The Electric Welder Controller Company, Pittsburgh, Pa., have prepared a four-page folder describing the Mann Master Controller, illustrated in the accompanying photograph in which the current control system is the Mann Master Controller. The welder shown is a two operator, 300 ampere, portable type. When



New Mann Arc Welder.

used as a single operator set the current range is given at 10 to 350 amperes. It has an emergency step for intermittent cutting with a current of 700 amperes. The small box shown at the left in the illustration is a locker and tool box for the operator. An interesting feature of the new folder is an oscillogram showing the savings made by using the current control system.

UNION CARBIDE ACQUIRES U. S. VANADIUM CO.

The Union Carbide and Carbon Corporation of New York City has purchased the assets of the United States Vanadium Co., including the ore bodies located on the western slope of the Rocky Mountains, about three hundred miles west of Denver. It is reported that the Electro Metallurgical Sales Corporation, a subsidiary of the Union Carbide and Carbon Corporation, will handle the selling of the vanadium oxide and ferro vanadium produced in the plant of the United States Vanadium Co.

NEW WICKWIRE-SPENCER STOCK BOOK

The Wickwire-Spencer Steel Company, 41 E. 42nd street, New New York, have recently issued a new fourteen page booklet describing their line of gas and electric welding rods. This gives the analyses of the different grades of rods and in the case of arc welding recommends the current best suited for different sizes of wire. A recent addition to the line is a special electrode material for automatic arc welding machines.

SET DATE FOR G. P. A. CONVENTION

Announcement has been made that the thirteenth mid-winter convention of the gas products association will be held in Chicago on January 20-21-22. The program is being prepared by a special committee and will be announced later. An interesting feature of the program will be the first showing of the motion picture film on oxy-acetylene welding, which has been in course of preparation during the past year.

CUTTING TORCH MAKES ATTRACTIVE SIGN

The Indiana Oxygen Company of Indianapolis, Indiana, believes that they have something new and unusual in the way of signs for their delivery trucks.

From the illustration the sign which appears to be painted

Truck Signs Made with Cutting Torch.

white is a 5-16 inch steel plate with the letters forming the words cut out by means of a cutting torch. The plate was then treated to make it rustproof which accounts for the color. The trucks are painted a bright green striped with white, which blends with the silver or white color of the sign.

AUSTRALIA WILL HAVE ITS OWN WELDING PAPER

Announcement has been received that the Victorian Institute of Welding Engineers, with headquarters at Melbourne, Australia, will start in January, 1927, publication of a welding journal called "The Australian Welding Engineer." A letter from Mr. A. Stanley Ridley states that the aim of the paper is to create a similar interest in welding as may justly be claimed by The Welding Engineer. The office of the Victorian Institute of Welding Engineers is at 440 Little Collins Street, Melbourne.

NEW FOLDER TELLS USES OF HARD SOLDER

A new folder, which has been prepared by the Weldene Corporation of Chicago, Illinois, gives a list of the typical jobs which can be handled by the use of hard solder. There are many occasions for repair which are not exactly adapted to welding and for which the ordinary soft solder will not work. There are also quite a number of aluminum repairs which can be handled with a special aluminum solder. The folder mentioned is noticeably free from extravagant claims for the soldering process as a substitute for welding. But attention is called to the wide range of work for which it is suitable, both in welding shops and industrial plants.

CLEVELAND WELDERS GET ACQUAINTED WITH SCHOOP PROCESS

The Schoop metal spraying process, which melts metal with the oxy-acetylene flame and blows it against a surface to be coated, by means of a compressed air jet, was explained in detail before a joint meeting of the Cleveland Section of the American Welding Society and the Cleveland Engineering Society, which was held in the Y. M. C. A. Trade School auditorium on Tuesday evening, November 30. An interesting feature of the program was that it brought out the possibility of building up cast iron parts and reclaiming cracked cylinder blocks by means of this process. There were 150 men in attendance to listen to this interesting discussion.

NEW TYPE OF HOSE COUPLING

Carl A. Norgren Co., 1150 California Street, Denver, Colorado, are manufacturing a hose coupling which they recommend particularly because of the ease with which it is applied to welding hose and the service which it gives. It is made in five sizes each for oxygen and fuel gas hose. The manufacturers point out that it may be removed instantly and applied again as often as is necessary. Two of these couplings were recently tested by the Pierce Testing Laboratories of Denver, Colo., pressure being applied in each case until the hose burst, without any sign of leak or slipping at the couplings or their connections.

AIRCO LEASES COMMERCIAL ACETYLENE PLANTS ON WEST COAST

"The Air Reduction Company, Incorporated, and Commercial Acetylene Supply Company announce that the Air Reduction Company has, as of November 1st, 1926, leased the acetylene plants of the Commercial Acetylene Supply Company, located at Berkeley and Los Angeles, California, and has taken over, and will continue to conduct the business formerly conducted by the Commercial Acetylene Supply Company at those points. The Commercial Aectylene Supply Company will continue to operate all of its other plants without any change of management or control."

LIST OF COPPER ALLOY WELDING RODS

Indications for the use of brass and bronze welding rods of different alloys are given in an eight page booklet prepared by the American Brass Company, which describes the use for Tobin bronze, silicon copper, phospho bronze, manganese bronze and muntz metal. There is also included in the booklet data on the weight per foot of welding rods of these different alloys, feet per pound, melting points and tensile strength.

NEWS OF THE WELDING TRADE

The Wickwire Spencer Steel Company has announced the appointment of the Buckeye Welding Supply Company, 1238 St. Clair Avenue, Cleveland, Ohio, as distributors of their welding wires. The Buckeye organization will carry a stock of welding wire at their Cleveland plant and handle sales for for the entire state of Ohio.

W. M. Bastable, until recently sales manager for the Wilson Welder & Metals Company, Hoboken, New Jersey, has been appointed manager of the New York Office of the Electric Welder Controller Company of Pittsburgh, Pennsylvania, manufacturers of the Mann Master Controller, and the Mann Welding Machine. The New York Office is located at 26 Cortlandt Street.

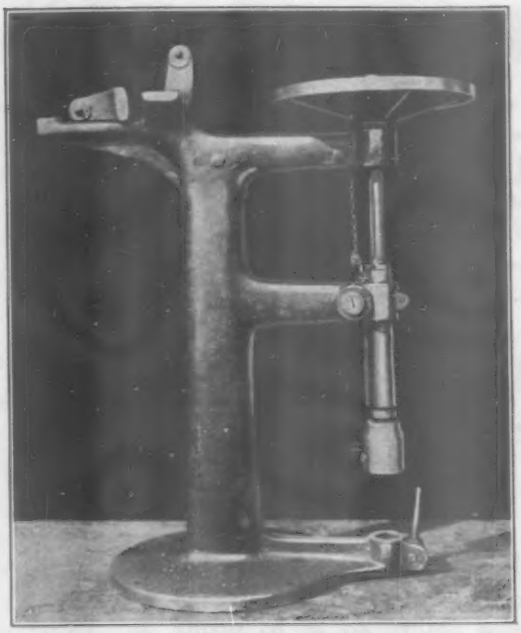
A. M. Candy, of the Westinghouse Electric & Manufacturing Company, addressed the Eastern New York Section of the A. S. M. E. at Schenectady, New York, November 30th, on the subject of welding structural steel.

Friends of Mr. Richard S. Wood, president of the Stevenson Distributing Corporation of New York City, owner of Shoot-a-lite, will be glad to know that he is convalescing in the New York Hospital, after a recent operation.

The membership directory of the Compressed Gas Manufacturers Association has just been issued and a large number of copies are being mailed by the Association to industrial organization, laboratories, association headquarters, etc. Some additional copies are available for distribution if names are supplied to the secretary, John H. Luening, at 120 W. 42nd St., New York City.

Mr. M. W. Pierce, formerly with the Cutler-Hammer Manufacturing Company, Milwaukee, is now associated with Mr. J. F. Romadka, as a partner in the Welding Equipment Company, Chicago, Illinois, who are distributors for U. S. L. arc welding equipment in Illinois, Iowa, Indiana and Wisconsin.

TOBIN BRONZE WELDED



In many shops broken castings such as this would be discarded. They could be saved with Tobin Bronze.

Tobin Bronze permeates the cast iron and knits the broken parts together in a permanent bond stronger than the casting itself.

A SUDDEN stress or strain often causes a serious break in machine parts made of cast iron. The upper photograph shows such a break in a drill press frame and the lower illustration shows the break permanently welded with Tobin Bronze.

Tobin Bronze welding by the oxy-acetylene process is particularly adapted to such repair work since strong, dependable welds can be made at a red heat without extensive pre-heating. Because of the low temperature required, many repairs can be made in place without dismantling. Another advantage of the low welding temperature is that shrinkage of the metal is minimized, making it possible to control alignment accurately.

The advantages of Tobin Bronze welding are speed, accuracy, permanent strength and economy. Many manufacturers who have proved the value of this method in repair work are now using it to save time and money in manufacturing operations.

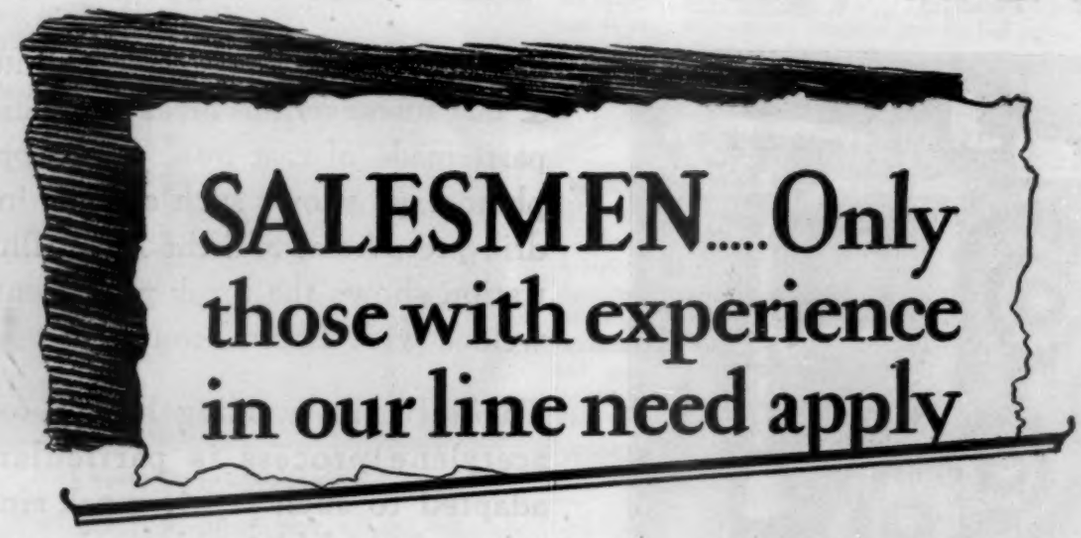
THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ontario

TOBIN BRONZE

REGISTERED U.S. PATENT OFFICE

WELDING RODS

EXCLUSIVELY AN ANACONDA PRODUCT



YOUR primary consideration, in choosing a salesman is his knowledge of the field. In addition he must be industrious —he must possess personality and sales ability so as to profit you by his knowledge.

Why not insist upon the same qualifications for the carriers of your written sales messages? Your advertisements to industry and trade should parallel the efforts and ability of your salesmen, in every particular, in order to reap the greatest benefit from your selling efforts.

Business Papers are the market places of the fields of trade and industry which they serve. They are no publisher's whim, but were created by an industrial demand. The extent to which they are satisfying this demand is evidenced by the constantly increasing number of advertisements which they carry and subscribers whom they serve.

In planning your advertising—consider the salesman. Give him the best assistance—increase his effective selling hours by using Business Papers.

Why not drop a line to our advisory service division? Let us show you how your advertising efforts can be made most effective by paralleling the work of your salesmen.

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Executive Offices: 220 West 42nd St., New York, N. Y.

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An association of none but qualified publications reaching the principal fields of trade and industry.

THE WELDING ENGINEER is a member of The Associated Business Papers, Inc.

Give Every Weld a Wodack Finish

The WODACK Portable Electric Grinder makes it easy to put a smooth finish on every welded job. The WODACK universal motor works on both A. C. and D. C. power supply, from a light socket. The WODACK Grinder is strongly built, but easy to handle.

Wodack Electric Tool Corporation

43 S. JEFFERSON ST. CHICAGO, ILL.

The offices of the Welding Equipment Company have been moved from 750 First National Bank Building, Chicago, to new and larger quarters at 609-610 Transportation Building, Chicago. Mr. A. W. Donop and Mr. E. K. Gordon of the U. S. Light & Heat Corporation have located down town offices in the same suite with the Welding Equipment Company.

Mr. T. A. Oberhellmann, formerly representing the Lincoln Electric Company in St. Louis and vicinity, has recently organized the Progressive Welder Sales Company for the distribution of the U. S. L. arc welder, manufactured by the U. S. Light and Heat Corporation, Niagara Falls, New York, covering the terrritory throughout the mid-west. Offices and warehouse are now located at 1025 N. Sixth Street, St. Louis, Missouri.

A recent issue of the American Architect contains a letter from Mr. A. F. Jensen, President of the Hanna Engineering Works, Chicago, which sounds a note of warning against making too broad statements in favor of welding as against riveting. It emphasizes the point that riveting is accepted as being dependable and fundamentally sound.

A. F. Davis, Vice-President of the Lincoln Electric Company, contributed to Printers' Ink Monthly for December an article entitled "Why We Discarded Dignity in Advertising a Technical Process." It describes the present campaign of the Lincoln Electric Company for selling welding to supplant castings and incidentally broadcasts a considerable volume of interesting information on the value of the arc welding process.

IMPERIAL WELDING AND CUTTING EQUIPMENT
OXY-ACETYLENE PROCESS

New Mixing Principle

a regulator that accurately controls gases, the greatest working range ever covered by ONE torch—are exclusive IMPERIAL features.

WRITE FOR CATALOG

IMPERIAL BRASS MFG. CO.
517 S. Racine Ave. Chicago, Ill.

ELECTRIC WELDING MACHINES

Did you ever need one in a hurry?
Have you any surplus machines you want to sell?
Do you want to exchange the one you now have?
Write us if you want to buy, sell or exchange.

GOODMAN ELECTRIC MACHINERY CO., 126 Green St., Newark, N. J.

WELDING ROD HOLDER
FOR THE OXY ACETYLENE WELDER
$1.00
ALL STEEL WIRE BRUSHES
SEND $1.00 FOR 5 ASSORTED BRUSHES
Money refunded on return of goods, if not what you want.
WRITE FOR DEALERS' PRICES
C. SORENSEN, 18 E. 16th ST., CHICAGO

Classified Ads

Wanted—Manager for factory manufacturing oxy-acetylene equipment. Must have the technical and mechanical knowledge and be able to invest from $5,000 to $10,000. Opportunity to grow with the business and make money according to your ability. Address Box 100, care The Welding Engineer.

Position Wanted—First class gas, electric and acetylene welding instructor and supervisor. Seven years experience, best of references. Selling, estimating and executive ability. Present field of endeavor too small. Desires permanent position. Address 101, care The Welding Engineer.

For Sale—One D. B. welding torch, one D. B. cutting torch, 16 tips, oxygen and acetylene regulators, two 25 foot lengths of hose, one carbon burning torch. All in steel case, never used, guaranteed one year. Will sell on best offer. Fidelity Garage, 5235 Cottage Grove Avenue, Chicago, Illinois. Ask for Mr. McQuaid.

Wanted—Salesman to sell acetylene, oxygen and apparatus. Man with experience preferred. Good future for right man. Territory Chicago and vicinity. Address 103, care The Welding Engineer.

Wanted—Experienced salesman who can sell arc welding apparatus in Chicago territory. Must have qualities that will produce orders on first class line. Address 104, care The Welding Engineer.

For Sale—Service Rights on W. K. and W. C. Prest-O-Lite cylinders, large or small quantities. Alfred E. Corp, 40 Mathewson Street, Providence, R. I.

Generators for Sale—1 Davis-Bournonville acetylene generator, Serial 13588, capacity 200 cubic feet of 1¼ x ⅜ carbide. 1 Davis-Bournonville acetylene generator, Serial 13569, capacity 100 cubic feet of 1¼ x ⅜ carbide. Both of above are in excellent condition and will be sold to the first party making a reasonable offer for same. The Kirk & Blum Manufacturing Company, 2846 Spring Grove Ave., Cincinnati, Ohio.

Every Welder's Library

If You Haven't Read This Page Before, Do It Now—
Getting the Most Out of Your Work Means Constant Study

The Welding Encyclopedia, by Mackenzie and Card, is written for you men who want to know all about welding. It not only solves your welding problems but will also give you a fund of welding knowledge which will increase the efficiency of your shop. Its contents cover in detail all phases of autogenous welding, and in addition many useful charts, tables, rules, regulations, etc. 435 pages, 375 illustrations, bound in black imitation leather. Price $5.00.

Automobile Welding with the Oxyacetylene Flame, by M. Keith Dunham. Explains in a simple manner the apparatus to be used, its care, and how to construct the necessary shop equipment. Tells how to weld all automobile parts in a manner understandable by anyone. 167 pages. 66 illustrations. Pocket size. Price $1.50.

Electric Welding, by Erik Oberg—A practical book that embodies the results obtained and the methods used by the most prominent concerns in the United States. 295 pages. Fully illustrated. Gives the data and information on electric welding that the man in the machine building shop requires. Price $3.50.

Oxyacetylene Welding Manual, by Lorn Campbell, Jr.—A book of instructions for the beginner. Treats of welding cast iron, steel, aluminum and malleable iron, cutting, preheating, and carbon burning. 172 pages. 92 illustrations. Price $1.50.

Electric Welding, by Ethan Viall—The uses and principles of construction of arc welding equipment. Automatic welding, butt welding and spot welding. Illustrations and descriptions of many commercial machines. 417 pages, 329 illustrations. Price $4.00.

Gas Torch and Thermit Welding, by Ethan Viall—The book describes in detail just how to make every common type of weld. Many American made torches are shown and described. Two special chapters are devoted to mechanical details of machines for gas welding and cutting. 434 pages, 342 illustrations. Price $4.00.

Electric Arc Welding, by E. Wanamaker and H. K. Pennington. The book covers descriptions of welding systems and their installations, phenomena of the metallic and carbon welding arc, training of operators, methods for applying metal to various types of joints and building-up operations, electrode materials used, weldability of various metals, weld composition, thermal disturbances of parts affected by the welding process, physical properties of completed welds, efficiency of welding equipments, welding cost, etc. 254 pages, 167 illustrations. Size 5 in. x 9 in. Bound in cloth. Price $4.00.

Arc Welding Hand Book—"The Arc Welding Hand Book," by C. J. Holslag, Chief Engineer, Electric Arc Cutting & Welding Co. This book is comprised of 250 pages and numerous illustrations. It is intended to serve as a simple and practical instruction in arc welding, and an attempt has been made to describe the methods, step by step, so that the beginner may understand both the equipment and the process. Price $2.00.

Oxy-Acetylene Welding and Cutting, by P. F. Willis. The revised and enlarged sixth edition has been brought right up-to-date by the addition of much new matter. It teaches you the care of apparatus, welding of all metals and alloys, how to take care of expansion and contraction, soldering aluminum, repairing scored cylinders and many other things which manufacturers, metal workers, railroad operators and blacksmiths desire to know. Price $1.50.

British Acetylene and Welding Handbook, by a Committee of the British Acetylene and Welding Association. Contains historical and scientific data relating to acetylene, oxygen and carbide. Treatises on the application of acetylene and oxy-acetylene welding and oxy-acetylene cutting. Tests, specifications, regulations, transport conditions, etc., and also the complete reference on acetylene and acetylene welding. Bound in cloth. Price $3.00.

Fundamentals of Welding—Gas, Arc and Thermit, by James W. Owens. Covers all kinds of welding, gas, arc, thermit and resistance. It describes and explains how each is done, and shows which sort is best and cheapest for each purpose, how to calculate stresses and strengths, how to inspect and test a weld, explains the metallurgy of the various welding processes, describes all the kinds of machines and apparatus, and shows advantageous shop layouts and arrangements. Price $10.00.

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Welding Wire

is uniform in quality throughout the same shipment and throughout all shipments. It is giving utmost satisfaction wherever used and is guaranteed to make perfect welds with the least amount of trouble in welding.

Low Carbon—
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John A. Roebling's Sons Company
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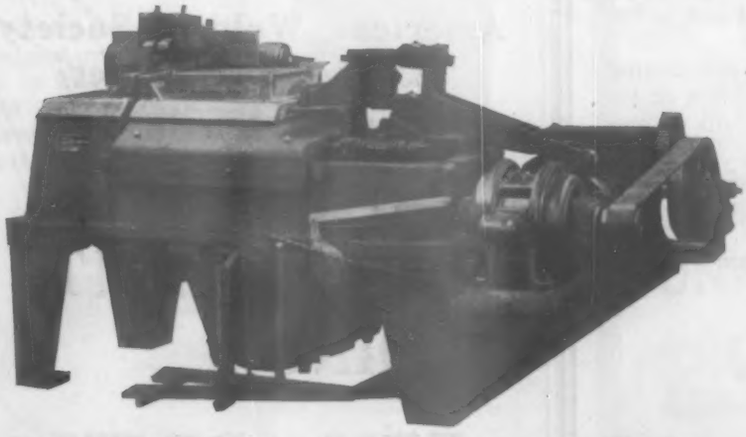

No. 80 Type Automatic Rim Butt Welder

The motor driven mechanism for applying the final pressure, when the metal is properly heated, eliminates manual labor in welding steel rims. Time, current and pressure are automatically controlled. This enables the operator to turn out 600 welded rims per hour on 4″ by 9/32″ stock.

The welds are uniform.

Welds 24 hours,
then starts a new day

The capacity of the machine illustrated is 600 rims per hour, which is equivalent to 6000 rims every ten hours. This is one of the hundreds of production problems which have been solved by our machines. Our engineers are always prepared to undertake new production problems. You are invited to consult us regarding your own work.

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Machine & Welder Co.
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Over 8 Years of Service—Not One Sign of Deterioration

If the filler of an acetylene cylinder is made of inferior materials and is poorly constructed, it soon sags. As a result, it becomes unsafe and must be taken out of service.

Users of Hackney Cylinders are never troubled with such results.

In 1924 a gas producer found that some of his Hackney Cylinders, manufactured in 1916, had accumulated as high as 10 pounds of water. This was caused by the lack of driers in his compressing units.

He devised a method of extracting this water, and in order to determine what effect it had on the asbestos filler, a number of cylinders were sectionized both before and after the extraction process.

It was found that the core had in no way deteriorated. There was no sagging and no breaking down of the structure. And these Hackneys all had records of over 100 fillings each.

This specific instance is a good example of the safety and dependability of Hackney's asbestos core. And it shows one more reason why 99 7/10% of the 70,000 Hackney Cylinders manufactured in the last 15 years are in active service today.

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PRESSED STEEL TANK COMPANY
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The Installation Cost Problem Solved

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NEW IMPROVED

SENECA Electric ARC WELDER

Our terms are so convenient that you need no longer try to get along without arc welding. Only a small cash payment is needed to start this machine making profits for you. Let arc welding build your business for you. The new improved Seneca A. C. Arc welder is the machine to do it.

Seneca Electric Arc Welder Co.
Seneca, Kansas

American Welding Society
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WHO ARE ITS MEMBERS?

The Secretary has a copy of the Membership Directory for you. Write for it.

Uniform Quality Assured

WELDERS who use Commercial Acetylene soon learn that every cylinder contains the same pure gas.

Your torch can tell the difference!

COMMERCIAL ACETYLENE
Means pure acetylene.

COMMERCIAL SERVICE
Means prompt service.

No matter what your gas requirements may be you will be interested in our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

10x30-in. size	125 cu. ft. cap.
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Because:

1. They have a welding current capacity of 75 to 450 amperes.
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Available in single or double operator Units.

UNA WELDING RODS

A complete line of coated rods for A.C. and D.C. Arcs, for light and heavy duty welding, for copper, bronze, steel and cast iron.

Una Welding and Bonding Company

Cleveland, Ohio

UNA Welders
Welding Rods

Big Industries Are Using
the
WELDENE
PROCESS

BEFORE

AFTER

This refrigerating machine condenser was broken beyond ordinary repair, but it was saved by the WELDENE process.

Arc welds on cast iron can be made water tight by using WELDENE wherever porous spots occur. Foundries using the arc to repair spongy spots in castings find that WELDENE makes every job a success.

Weldene is non porous.

If you are having trouble with cast iron welds, all you need is WELDENE. Ask your dealer, or write us direct.

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608 S. Dearborn St.
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Dixon's Graphite Rods and Plates for Welding

Made in all diameters, lengths and sizes.

Small diameter rods are sold in 4, 6 and 8 inch lengths, the shorter the rod the less breakage in shipping.

Also Dixon's Graphite Welding Putty. In 5 and 10 lb. cans.

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JERSEY CITY, N. J.
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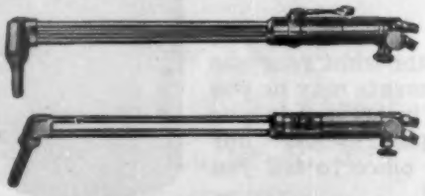

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Today, as a result of unceasing effort and of scientific control of all manufacturing processes at the mill, Page-Armco and Page Welding Wire and Electrodes stand pre-eminent for quality—and are rapidly being specified as standard wherever perfect work is demanded.

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Welding Wire *and* Electrodes

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Seamless Monolithic filled acetylene cylinders have successfully undergone practically every conceivable kind of a test in actual service. The result has always been the same, namely, 100% safety.

The truly seamless shell made entirely from one piece of carefully selected steel always will remain in one piece regardless of heat, pressure or other conditions.

Monolithic filler with a crushing strength of several hundred pounds per square inch cannot weaken, sag or deteriorate.

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Welding Rod

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Burke Arc Welders

Single Operator and Two Operator Machines

for electric motor, gasoline engine or belt drive and for either stationary or portable service

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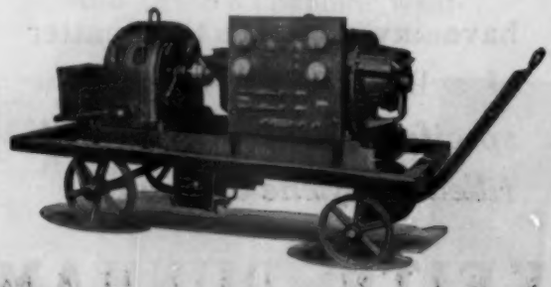

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Ideal Face Shields protect the head, chest and neck against direct and reflected rays. Easily adjusted and removed. Constructed of vulcanized fibre and aluminum, assuring durability and lightness. Hinged door allows quick inspection of work or interchange of glasses.

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The Ideal Glove for Electric and Acetylene Welders is made from Sheep Skin, which has been Subjected to an Asbestos Treatment and which makes it both heat resisting and fireproof.

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The Ideal Apron for Welders is made of leather which has been especially treated to stand the heat, and at the same time be very flexible and durable.

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Grade "A" Coppered Acetylene Welding Rods

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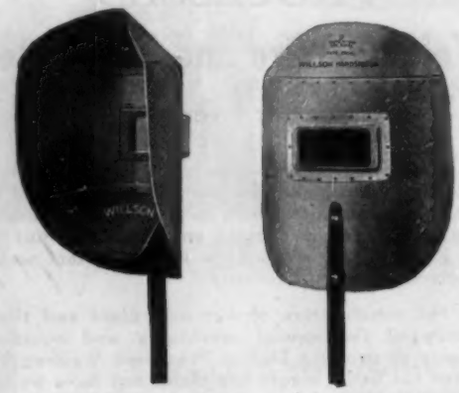

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Operation	Previously Used Material	Elkonite
Radio panels	100 welds	8,000 welds
Brass radiator shells	16,000 welds	400,000 welds
Wire to heavy metal	300 welds	12,000 welds
Motor frame assembly	15 welds	400 welds
Wire to tin plate	50,000 welds	2,500,000 welds (incomplete)
Galvanized steel wire	15,000 welds	225,000 welds
Roller bearing assembly	24,000	400,000

Elkonite Welding Electrodes remain hard, *without mushrooming*, under red heat, great pressures and heavy electric currents.

They have made the spot welding of brass, tinned iron, galvanized iron and aluminum commercially practicable.

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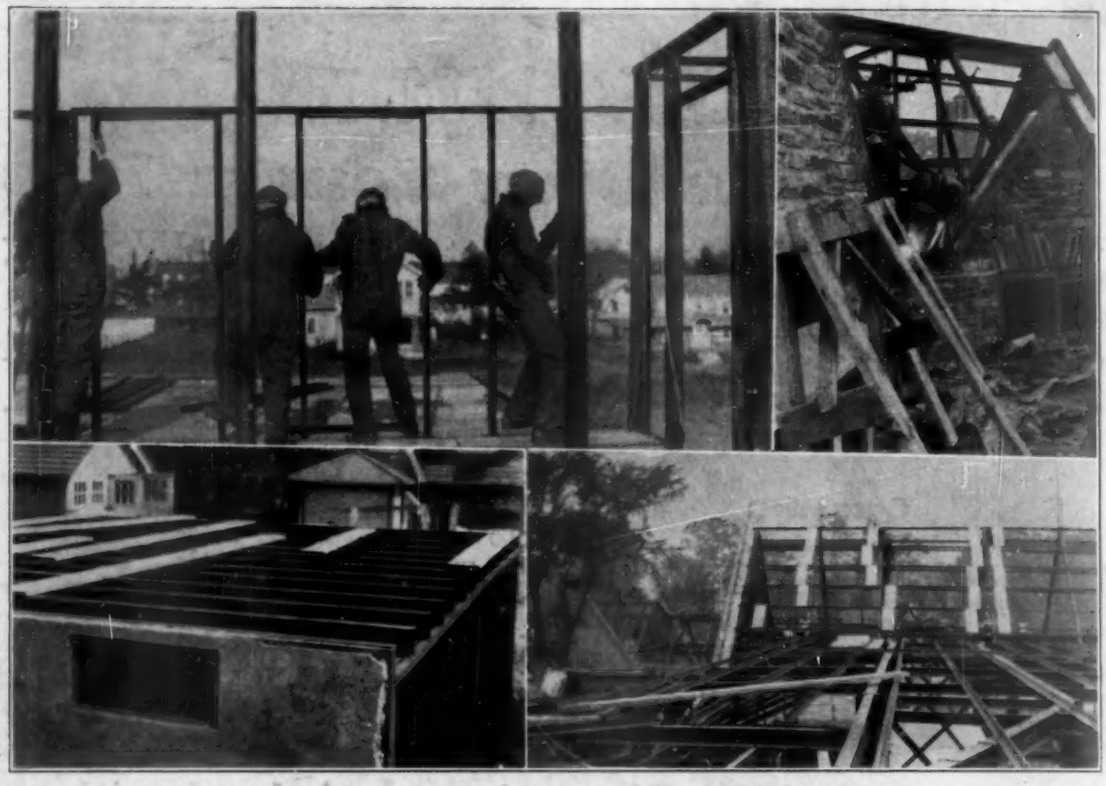

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